

# **SPECIFICATIONS**

**Solicitation No. DACW45-03-B-0010**

## **Rearing Ponds & Hatchery Complex**



### **Fort Peck Fish Hatchery Fort Peck, MT**

March 2003



**US Army Corps  
of Engineers**  
Omaha District

**Rearing Ponds and Hatchery Complex  
Fort Peck Fish Hatchery  
Fort Peck, MT**

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<b>SOLICITATION, OFFER, AND AWARD</b> (Construction, Alteration, or Repair)	1. SOLICITATION NO.  DACW45-03-B-0010	2. TYPE OF SOLICITATION  <input checked="" type="checkbox"/> SEALED BID (IFB) <input type="checkbox"/> NEGOTIATED (RFP)	3. DATE ISSUED  31 Mar 2003	PAGE OF PAGES  1 OF 4
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IMPORTANT - The "offer" section on the reverse must be fully completed by offeror.

4. CONTRACT NO.	5. REQUISITION/PURCHASE REQUEST NO.	6. PROJECT NO.
7. ISSUED BY  U S ARMY ENGINEER DISTRICT, OMAHA 106 South 15th Street Omaha, Nebraska 68102-1618	CODE  CT	8. ADDRESS OFFER TO  U.S.ARMY CORPS OF ENGINEERS, OMAHA Attn: CONTRACTING DIVISION (CENWO-CT) 106 South 15th Street Omaha, Nebraska 68102-1618
9. FOR INFORMATION CALL:	A. NAME  See SECTION 00100, Para. 25	B. TELEPHONE NO. (Include area code) (NO COLLECT CALLS)  See SECTION 00100, Para. 25

**SOLICITATION**

NOTE: In sealed bid solicitations "offer" and "offeror" mean "bid" and "bidder".

10. THE GOVERNMENT REQUIRES PERFORMANCE OF THE WORK DESCRIBED IN THESE DOCUMENTS (Title, identifying no., date):

The Offeror hereby agrees to do all the work described in these documents entitled:

**Rearing Ponds and Hatchery Complex, Fort Peck Fish Hatchery, Fort Peck, MT**

**RETURN WITH BIDS: SECTION 00010 (SF1442), SECTION 00600 REPRESENTATIONS, CERTIFICATIONS & OTHER STATEMENTS OF BIDDERS, and all Bonding Requirements, See SECTION 00700 CONTRACT CLAUSES and SECTION 00100 for Performance and Payment Bonds.**

11. The Contractor shall begin performance within <u>10</u> calendar days and complete it within <u>730</u> calendar days after receiving <input type="checkbox"/> award, <input checked="" type="checkbox"/> notice to proceed. This performance period is <input checked="" type="checkbox"/> mandatory, <input type="checkbox"/> negotiable. (See _____.)	12A. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE AND PAYMENT BONDS? (If "YES," indicate within how many calendar days after award in Item 12B.) <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	12B. CALENDAR DAYS  10
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13. ADDITIONAL SOLICITATION REQUIREMENTS:

A. Sealed offers in original and 0 copies to perform the work required are due at the place specified in Item 8 by 2:00 pm (hour) local time 30 Apr 2003 (date). If this is a sealed bid solicitation, offers must be publicly opened at that time. Sealed envelopes containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due.

B. An offer guarantee  is,  is not required.

C. All offers are subject to the (1) work requirements, and (2) other provisions and clauses incorporated in the solicitation in full text or by reference.

D. Offers providing less than 60 calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.

14. NAME AND ADDRESS OF OFFEROR (Include ZIP Code)	15. TELEPHONE NO. (Include area code)
DUNS Number :	16. REMITTANCE ADDRESS (Include only if different than Item 14)
CODE	FACILITY CODE

17. The offeror agrees to perform the work required at the prices specified below in strict accordance with the terms of this solicitation, if this offer is accepted by the Government in writing within 60 calendar days after the date offers are due. (Insert any number equal to or greater than the minimum requirement stated in Item 13D. Failure to insert any number means the offeror accepts the minimum in Item 13D.)

**AMOUNTS**

SEE ATTACHED BIDDING SCHEDULE

Contractor's Fax No. \_\_\_\_\_ CAGE CODE \_\_\_\_\_  
 Contractor's E-Mail address \_\_\_\_\_

18. The offeror agrees to furnish any required performance and payment bonds.

**19. ACKNOWLEDGMENT OF AMENDMENTS**

(The offeror acknowledges receipt of amendments to the solicitation - give number and date of each)

AMENDMENT NO.									
DATE									

20A. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER (Type or print)	20B. SIGNATURE	20C. OFFER DATE
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**AWARD (To be completed by Government)**

21. ITEMS ACCEPTED:

22. AMOUNT	23. ACCOUNTING AND APPROPRIATION DATA
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24. SUBMIT INVOICES TO ADDRESS SHOWN IN (4 copies unless otherwise specified)	ITEM <b>26</b>	25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO <input type="checkbox"/> 10 U.S.C. 2304(c) ( ) <input type="checkbox"/> 41 U.S.C. 253(c) ( )
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26. ADMINISTERED BY  U.S. Army Engineer District, Omaha 106 South 15th Street Omaha, Nebraska 68102-1618	CODE	27. PAYMENT WILL BE MADE BY  USAED Omaha c/o USACE Finance Center 5722 Integrity Drive Millington, TN 38054-5005
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**CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE**

<input type="checkbox"/> <b>28. NEGOTIATED AGREEMENT</b> (contractor is required to sign this document and return _____ copies to issuing office.) Contractor agrees to furnish and deliver all items or perform all work, requisitions identified on this form and any continuation sheets for the consideration stated in this contract. The rights and obligations of the parties to this contract shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications incorporated by reference in or attached to this contract.	<input type="checkbox"/> <b>29. AWARD</b> (Contractor is not required to sign this document.) Your offer on this solicitation, is hereby accepted as to the items listed. This award commutes the contract, which consists of (a) the Government solicitation and your offer, and (b) this contract award. No further contractual document is necessary.
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30A. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED TO SIGN (Type or print)	31A. NAME OF CONTRACTING OFFICER (Type or print)
30B. SIGNATURE	30C. DATE
31B. UNITED STATES OF AMERICA	
BY	31C. AWARD DATE

**BIDDING SCHEDULE**

<u>Item No.</u>	<u>Description</u>	<u>Estimated Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Amount</u>
<b><u>BASIC</u></b>					
1.	Entire work complete excluding item 2. and options below.	Job	L.S.	xxx	\$ _____
2.	Electronic Equipment as shown on the Drawings and in the Specs	Job	L.S.	xxx	\$8,000
<b><u>OPTIONS</u></b>					
0-1	All work complete for Rearing Pond Liners 31 thru 40 as show on Sheet U1.06	Job	L.S.	xxx	\$ _____
0-2	All work complete for the Roof Canopy and Raceway As shown on Sheet AC.02	Job	L.S.	xxx	\$ _____
0-3	All work complete for the Landscaping as shown on the drawings and in the Specs	Job	L.S.	xxx	\$ _____
0-4	All work complete for providing and installation of additional crushed rock for the west equipment area, as shown on the drawings and in the specs	475	Tons	\$ _____	\$ _____
TOTAL AMOUNT (BASIC + OPTIONS)					\$ _____ (in figures)

Notes:

1. See SECTION 00100, INSTRUCTIONS, CONDITIONS, & NOTICES TO BIDDERS for evaluation of options. The Government reserves the right to exercise the options at time of award.
2. Bid prices must be entered for all items of the schedule. Total amount bids submitted without bid prices being entered on individual

items will be rejected. Additions will be subject to verification by the Government. In case of variation between the lump-sum prices and the total amount, the lump-sum prices will be considered the bid.

3. A modification to a bid which provides for a single adjustment to the total amount bid, should state the application of the adjustment to each respective lump-sum price affected. If the modification is not so apportioned, the single adjustment will be applied to Item No. 1.
4. For Electronic Equipment see Section 00800 Paragraph 1.1.2 and Section 10100A.

SECTION 00100

INSTRUCTIONS, CONDITIONS & NOTICES TO BIDDERS  
(July 2000, Revised February 2003)

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SECTION 00100

INSTRUCTIONS, CONDITIONS & NOTICES TO BIDDERS

**1 GENERAL BIDDING INFORMATION**

Bids shall be either mailed or hand-carried as indicated below. Bid will be PUBLICLY opened at the bid time indicated on Standard Form SF 1442 (Page 00010-1).

**1.1 MAILED BIDS AND HAND-CARRIED BIDS**

Mailed bids shall be addressed to the location as indicated on Standard Form SF 1442 (Page 00010-1), Item No. 8.

Due to heightened security at Government installations, those bidders who have their bids hand-carried\* shall contact Jan Cook, Contract Specialist at (402) 221-4118 or (402) 221-4100 prior to delivering to the U. S. Army Corps of Engineer District, Omaha, 106 South 15<sup>th</sup> Street, Omaha, NE.

On the date specified and for thirty (30) minutes prior to time specified on Standard Form SF 1442, Page 00010-1, item 13.A, a Contracting representative will be in the lobby to receive bids. At the time specified on Standard SF 1442 Page 00010-1, item 13.A, the designated bid opening official will announce that receipt of bids is closed. Official time will be established by time/stamp clock located in the area where bids are received.

Anyone wishing to attend this public opening will be required to present photo identification to sign in and then will be escorted to the facility where bids will be opened. Once bids have been opened, read and recorded, attendees will then be escorted to exit the building.

\*This instruction shall also apply to those bids delivered through a delivery or parcel service.

**1.2 SOLICITATION RESTRICTIONS**

This solicitation is unrestricted and open to both large and small business participation.

**1.3 BASIS FOR AWARD.**

IT IS INTENDED THAT AWARD WILL BE MADE TO ONE BIDDER FOR THE ENTIRE WORK.

**1.4 APPROPRIATION AND AUTHORITY**

APPROPRIATION: 96 X 3122 Construction General

AUTHORITY: The work provided for herein is authorized: Section 325 of the Water Resources Development Act of 2000.

## **1.5 DESCRIPTION OF WORK**

The scope of this project is to furnish all plant, labor, materials, and equipment and performing all work for the construction of the Fort Peck Fish Hatchery, Rearing Ponds and Hatchery Complex, complete. Primary components of work include the construction of 9-0.5 acre rearing ponds, 23-1.0 acre rearing ponds, and 9-2.0 acre rearing ponds, complete with all related fill and drain piping, and all other related site work. All ponds shall be provided with chimney structures for harvesting of fish. Seven kettles shall be constructed for capture of fingerlings from the ponds. Two settling ponds shall be constructed to capture all water drained from the ponds and hatchery complex. The Hatchery Complex consists of a building of approximately 33,000 square feet, which includes administrative areas (office/staff/meeting areas); maintenance/vehicle bays; and hatchery production areas, which comprise fish rearing and mechanical/electrical support areas. A mezzanine is also included within the hatchery building as part of the water treatment and equipment storage requirements. The successful contractor shall be required to coordinate the successful connection of the piping and control wiring from the phase one construction contract, Intake Structure and Pump House. Work shall be in accordance with plans and specifications issued with this solicitation, and not be limited to the above description.

## **1.6 ESTIMATED CONSTRUCTION COST**

The estimated construction cost of this project is between \$10,000,000 and \$15,000,000.

## **2 (FAR 52.214-6) EXPLANATION TO PROSPECTIVE BIDDERS (APRIL 1984).**

Any prospective bidder desiring an explanation or interpretation of the solicitation, drawings, specifications, etc., must request it in writing soon enough to allow a reply to reach all prospective bidders before the submission of their bids. Oral explanations or instructions given before the award of a contract will not be binding. Any information given a prospective bidder concerning a solicitation will be furnished promptly to all other prospective bidders as an amendment to the solicitation, if that information is necessary in submitting bids or if the lack of it would be prejudicial to other prospective bidders.

## **3 RESERVED**

(NOTE: FACSIMILE, ELECTRONIC COMMERCE OR TELEGRAPHIC BIDS ARE NOT AUTHORIZED AND WILL NOT BE ACCEPTED. TELEGRAPHIC MODIFICATIONS OR WITHDRAWAL OF BIDS ARE AUTHORIZED. FACSIMILE MODIFICATIONS OR WITHDRAWAL ARE NOT AUTHORIZED.)

## **4 (FAR 52.214-5) SUBMISSION OF BIDS (MAR 1997).**

(a) Bids and bid modifications shall be submitted in sealed envelopes or packages (unless submitted by electronic means) (1) addressed to the office specified in the solicitation and (2) showing the time and date

specified for receipt, the solicitation number, and the name and address of the bidder.

(b) Bidders using commercial carrier services shall ensure that the bid is addressed and marked on the outermost envelope or wrapper as prescribed in subparagraphs (a) (1) and (2) of this provision when delivered to the office specified in the solicitation.

(c) Telegraphic bids will not be considered unless authorized by the solicitation; however, bids may be modified or withdrawn by written or telegraphic notice.

(d) Facsimile bids, modifications, or withdrawals, will not be considered unless authorized by the solicitation

(e) Bids submitted by electronic commerce shall be considered only if the electronic commerce method was specifically stipulated or permitted by the solicitation.

**5 (FAR 52.214-18) PREPARATION OF BIDS - CONSTRUCTION (APRIL 1984).**

(a) Bids must be--

- (1) Submitted on the forms furnished by the Government or on copies of those forms, and
- (2) **Manually signed.** The person signing a bid must initial each erasure or change appearing on any bid form.

(b) The bid form may require bidders to submit bid prices for one or more items on various bases, including--

- (1) Lump sum bidding;
- (2) Alternate prices;
- (3) Units of construction; or
- (4) Any combination of subparagraphs (1) through (3) above.

(c) If the solicitation requires bidding on all items, failure to do so will disqualify the bid. If bidding on all items is not required, bidders should insert the words "no bid" in the space provided for any item on which no price is submitted.

(d) Alternate bids will not be considered unless this solicitation authorizes their submission.

**6 (FAR 52.214-4) FALSE STATEMENTS IN BIDS (APRIL 1984).**

Bidders must provide full, accurate, and complete information as required by this solicitation and its attachments. The penalty for making false statements in bids is prescribed in 18 U.S.C. 1001.

(NOTE: FACSIMILE, ELECTRONIC COMMERCE OR TELEGRAPHIC BIDS ARE NOT AUTHORIZED AND WILL NOT BE ACCEPTED. TELEGRAPHIC MODIFICATIONS OR WITHDRAWAL OF BIDS ARE AUTHORIZED. FACSIMILE MODIFICATIONS OR WITHDRAWAL ARE NOT AUTHORIZED.)

**7 (FAR 52.214-7) LATE SUBMISSIONS, MODIFICATIONS, AND WITHDRAWALS OF BIDS (NOV 1999) .**

(a) Bidders are responsible for submitting bids, and any modifications or withdrawals, so as to reach the Government office designated in the invitation for bids (IFB) by the time specified in the IFB. If no time is specified in the IFB, the time for receipt is 4:30 p.m., local time, for the designated Government office on the date that bids are due.

(b) (1) Any bid, modification, or withdrawal received at the Government office designated in the IFB after the exact time specified for receipt of bids is "late" and will not be considered unless it is received before award is made, the Contracting Officer determines that accepting the late bid would not unduly delay the acquisition; and-

(i) If it was transmitted through an electronic commerce method authorized by the IFB, it was received at the initial point of entry to the Government infrastructure not later than 5:00 p.m. one working day prior to the date specified for receipt of bids; or

(ii) There is acceptable evidence to establish that it was received at the Government installation designated for receipt of bids and was under the Government's control prior to the time set for receipt of bids.

(2) However, a late modification of an otherwise successful bid that makes its terms more favorable to the Government, will be considered at any time it is received and may be accepted.

(c) Acceptable evidence to establish the time of receipt at the Government installation includes the time/date stamp of that installation on the bid wrapper, other documentary evidence of receipt maintained by the installation, or oral testimony or statements of Government personnel.

(d) If an emergency or unanticipated event interrupts normal Government processes so that bids cannot be received at the Government office designated for receipt of bids by the exact time specified in the IFB and urgent Government requirements preclude amendment of the IFB, the time specified for receipt of bids will be deemed to be extended to the same time of day specified in the solicitation on the first work day on which normal Government processes resume.

(e) Bids may be withdrawn by written notice received at any time before the exact time set for receipt of bids. If the IFB authorizes facsimile bids, bids may be withdrawn via facsimile received at any time before the exact time set for receipt of bids, subject to the conditions specified in the provision at 52.214-31, Facsimile Bids. A bid may be withdrawn in person by a bidder or its authorized representative if, before the exact time set for receipt of bids, the identity of the person requesting withdrawal is established and the person signs a receipt for the bid.

(End of provision)

**8 INFORMATION FOR MODIFYING BIDS.**

Bids which have been delivered to the designated bid receiving office may be modified or withdrawn by mail, mailgram, or telegram received at any time before the exact time set for receipt of bids. Modifications or withdrawals sent by mail should be transmitted to the place of bid opening Standard Form SF1442 (Page 00010-1), Item 8. Telephone modifications or withdrawals, other than telecopier, will not be accepted. All bid modifications or withdrawals must be signed by the bidder or its authorized representative. Any questions regarding these procedures should be directed to the Omaha District's Contracting Division at (402) 221-4118. This number should also be used to verify the receipt of messages.

**9 BID GUARANTEE.**

See Contract Clauses clause FAR 52.228-1, BID GUARANTEE. Bid guarantee MUST be in an original and accompanied by an original power of attorney of the surety.

**10 PERFORMANCE AND PAYMENT BONDS.**

See Contract Clauses clause FAR 52.228-15, PERFORMANCE AND PAYMENT BONDS. To have the bond considered valid, both the bond and the Power of Attorney must be original. Facsimile copies will not be acceptable, and will render the bid invalid, therefore eliminating it from competition.

(NOTE: FOR THE PURPOSES OF THIS SOLICITATION, THE WORD "ITEM" SHALL BE CONSIDERED TO MEAN "SCHEDULE.")

**11 (FAR 52.214-19) CONTRACT AWARD - SEALED BIDDING - CONSTRUCTION (AUG 1996).**

(a) The Government will evaluate bids in response to this solicitation without discussions and will award a contract to the responsible bidder whose bid, conforming to the solicitation, will be most advantageous to the Government, considering only price and the price-related factors specified elsewhere in the solicitation.

(b) The Government may reject any or all bids, and waive informalities or minor irregularities in bids received.

(c) The Government may accept any item or combination of items, unless doing so is precluded by a restrictive limitation in the solicitation of the bid.

(d) The Government may reject a bid as nonresponsive if the prices bid are materially unbalanced between line items or subline items. A bid is materially unbalanced when it is based on prices significantly less than cost for some work, and prices which are significantly overstated in relation to cost for other work, and if there is a reasonable doubt that the bid will result in the lowest overall cost to the Government even though it may be the

low evaluated bid, of it is so unbalanced as to be tantamount to allowing an advance payment.

**12 NORTH AMERICAN CLASSIFICATION SYSTEM (NAICS) .**

In accordance with NAICS Manual, the work in this solicitation is assigned classification code 236210.

**13 SMALL BUSINESS SIZE STANDARD .**

This solicitation is not limited to small business concerns, but, for definition purposes, a concern is small if its average annual receipts for its preceding 3 fiscal years did not exceed \$28.5 million. (based on FAR 19.102)

**14 (FAR 52.214-3) AMENDMENTS TO INVITATIONS FOR BIDS (DECEMBER 1989) .**

- (a) If this solicitation is amended, then all terms and conditions which are not modified remain unchanged.
- (b) Bidders shall acknowledge receipt of any amendment to this solicitation (1) by signing and returning the amendment, (2) by identifying the amendment number and date in the space provided for this purpose on the form for submitting a bid, (3) by letter or telegram or (4) by facsimile, if facsimile bids are authorized in the solicitation. The Government must receive the acknowledgment by the time and at the place specified for receipt of bids. (FAR 52.214-3.)

**15 CHANGES PRIOR TO OPENING BIDS .**

The right is reserved, as the interest of the Government may require, to revise the specifications and/or drawings prior to the date set for opening bids. Such revisions will be announced by an amendment or amendments to this Invitation for Bids. It shall be the responsibility of the prospective bidder to obtain copies of amendments from the website listed in paragraph: PLAN HOLDER'S LIST below. The Government may (but not required) send an amendment notification to let prospective bidders know that an amendment has been issued. If the revisions and amendments are of a nature which requires material changes in quantities or prices to be bid, the date set for opening bids may be postponed as necessary, in the opinion of the Commander, to enable bidders to revise their bids. In such cases, the amendment will include an announcement of the new date for opening bids.

**16 (FAR 52.214-34) SUBMISSION OF OFFERS IN THE ENGLISH LANGUAGE (APR 1991)**

Offers submitted in response to this solicitation shall be in the English language. Offers received in other than English shall be rejected.

(End of provision)

**17 (FAR 52.214-35) SUBMISSION OF OFFERS IN U.S. CURRENCY (APR 1991)**

Offers submitted in response to this solicitation shall be in terms of U.S. dollars. Offers received in other than U.S. dollars shall be rejected.

(End of provision)

**18 (EFARS 52.214-5000) ARITHMETIC DISCREPANCIES.**

(a) For the purpose of initial evaluation of bids, the following will be utilized in resolving arithmetic discrepancies found on the face of the bidding schedule as submitted by the bidder:

- (1) Obviously misplaced decimal points will be corrected;
- (2) In case of discrepancy between unit price and extended price, the unit price will govern;
- (3) Apparent errors in extension of unit prices will be corrected;
- (4) Apparent errors in addition of lump sum and extended prices will be corrected.

(b) For the purposes of bid evaluation, the Government will proceed on the assumption that the bidder intends his bid to be evaluated on the basis of the unit prices, extensions, and totals arrived at by resolution of arithmetic discrepancies as provided above and the bid will be so reflected on the abstract of bids.

(c) These correction procedures shall not be used to resolve any ambiguity concerning which bid is low.

**19 (FAR 52.217-5) EVALUATION OF OPTIONS (JUL 1990).**

Except when it is determined in accordance with FAR 17.206(b) not to be in the Government's best interests, the Government will evaluate offers for award purposes by adding the total price for all options to the total price for the basic requirement. Evaluation of options will not obligate the Government to exercise the option(s).

**20 OPTIONS.**

The Government may reject an offer as nonresponsive if it is materially unbalanced as to prices for the basic requirement and the option quantities. An offer is unbalanced when it is based on prices significantly less than cost for some work and prices which are significantly overstated for other work.

**21 AVAILABILITY OF SPECIFICATIONS, STANDARDS, AND DESCRIPTIONS.**

Specifications, standards, and descriptions cited in this solicitation are

available as indicated below:

**21.1 (FAR 52.211-2) AVAILABILITY OF SPECIFICATIONS LISTED IN THE DOD INDEX OF SPECIFICATIONS AND STANDARDS (DODISS) AND DESCRIPTIONS LISTED IN THE ACQUISITION MANAGEMENT SYSTEMS AND DATA REQUIREMENTS CONTROL LIST, DOD 5010.12-L (DEC 1999) .**

Copies of specifications, standards, and data item descriptions cited in this solicitation may be obtained-

(a) From the ASSIST database via the Internet at <http://assist.daps.mil>; or

(b) By submitting a request to the-

Department of Defense Single Stock Point (DoDSSP)  
Building 4, Section D  
700 Robbins Avenue  
Philadelphia, PA 19111-5094  
Telephone (215) 697-2667/2179  
Facsimile (215) 697-1462.  
(End of provision)

**21.2 CORPS OF ENGINEERS SPECIFICATIONS.**

Corps of Engineers specifications of the CRD-C series may be obtained from the National Institute of Building Sciences Construction Criteria Base (CCB) on CD-ROM. Contact the CCB directly at (202) 289-7800 for an order form or obtain an order form at the following internet address:

<http://www.ccb.org/ccbsubscribe/Subsmain.asp>. There is a regular annual subscription fee to CCB of \$700 per year. (Note: This is considered to be the Contractor's responsibility and cost). This will include CCB on CD-ROM or DVD plus unlimited internet access plus access to the new Whole Building Design Guide, now under construction and scheduled for launch in October 2001. Selected Corps of Engineers specifications of CRD-C series are available in Acrobat Reader .pdf file format at the following internet address:

<http://www.wes.army.mil/SL/MTC/handbook/handbook.htm>.

**21.3 COMMERCIAL (NON-GOVERNMENT) SPECIFICATIONS, STANDARDS, AND DESCRIPTIONS.**

These specifications, standards, and descriptions are not available from Government sources. They may be obtained from the publishers.

**22 AVAILABLE PLANT.**

Each bidder shall, upon request of the Contracting Officer, furnish a list of the plant available to the bidder and proposed for use on the work.

**23 EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE.**

Whenever a contract or modification of contract price is negotiated, the Contractor's cost proposals for equipment ownership and operating expenses

shall be determined in accordance with the requirements of paragraph: EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE, contained in Section: 00800, SPECIAL CONTRACT REQUIREMENTS of the specifications. A copy of EP 1110-1-8 "Construction Equipment Ownership and Operating Expense Schedule" is available for review at the office listed in paragraph: SITE VISIT (CONSTRUCTION) herein or at the following internet address: <http://www.usace.army.mil/inet/usace-docs/eng-pamphlets/ep.htm>. (copy also included on CD-ROM issued with this solicitation). .

#### **24 NOTICE REGARDING BUY AMERICAN ACT.**

The Buy American Act (41 U.S.C. 10a-10d) generally requires that only domestic construction material be used in the performance of this contract. Exception from the Buy American Act shall be permitted only in the case of nonavailability of domestic construction materials. A bid or proposal offering nondomestic construction material will not be accepted unless specifically approved by the Government. When a bidder or offeror proposes to furnish nondomestic construction material, his bid or proposal must set forth an itemization of the quantity, unit price, and intended use of each item of such nondomestic construction material. When offering nondomestic construction material pursuant to this paragraph, bids or proposals may also offer, at stated prices, any available comparable domestic construction material, so as to avoid the possibility that failure of a nondomestic construction material to be acceptable under this paragraph will cause rejection of the entire bid. All bidders are cautioned that, prior Government conduct notwithstanding, the Contractor's selection of a domestic construction material (as defined in FAR 52.225-5 Buy American Act-Construction Materials) which would require the subsequent selection of a foreign construction material for compatibility is not a justification for waiver of the Buy American Act. It is the Contractor's responsibility to verify, prior to submitting the materials for approval, that each system can be built to meet the contract specifications without the use of foreign construction materials.

#### **25 (FAR 52.236-27) SITE VISIT (CONSTRUCTION) (FEB 1995).**

- (a) The clauses at 52.236-2, Differing Site Conditions, and 52.236-3, Site Investigations and Conditions Affecting the Work, will be included in any contract awarded as a result of this solicitation. Accordingly, offerors or quoters are urged and expected to inspect the site where the work will be performed.
- (b) Contractors interested in inspecting the site of the proposed work should contact Don Streib, Construction Representative Fort Peck Project Office, Administration Building, East Kansas, Fort Peck, Montana 59223 Phone 406-526-3411.

#### **26 BIDDER'S QUESTIONS AND COMMENTS.**

Questions and/or comments relative to these bidding documents should be submitted via e-mail or mailed to the address identified in paragraph: AVAILABILITY OF BID RESULTS below. Comments should reach this office no

later than 20 calendar days prior to the date set for opening of bids, if feasible, in order that changes, if needed, may be added by amendment. E-mail addresses, FAX numbers, items for question and points of contact are listed below. Phone calls with questions should be made between 8:30 a.m. and 3:30 p.m. (Central Standard Time) Monday through Friday.

**Note: A courtesy copy of all questions shall be sent to the Contract Specialist (Contractual Matters Point of Contact), the Program Manager and Specifications Section (Technical Content Points of Contact).**

<u>Items for Question</u>	<u>Points of Contact/ Phone numbers/ FAX Numbers</u>	<u>E-mail Addresses</u>
Contractual Matters: Ordering CD-Rom of the plans and specifications (limit One per firm)/ amendments**/ Bid Results (See Paragraph AVAILABILITY OF BID RESULTS, below)/ Receipt of Bids	Jan Cook 402-221-4118 (phone) 402-221-4199 (Fax)	Jan.M.Cook@usace.army.mil
Planholder's List	See paragraph: PLAN HOLDER'S LIST, below.	
Small Business Matters	Hubert Carter 402-221-4110 (phone)	hubert.j.carter@usace.army.mil
Technical Contents Of Plans and Specification	Ted Streckfuss 402-221-3824 (phone)	Ted.H.Streckfuss@usace.army.mil
	Or	
	Specifications Section Marylee Stobbe 402-221-4411 (Phone) 402-221-3842 (Fax)	Marylee.F.Stobbe@usace.army.mil
Site Inspection	See Paragraph: SITE VISIT (CONSTRUCTION), above	

**\*\* - The Government may elect to send a notification that an amendment has been posted to the Government's web address. It shall be the Contractor's, Subcontractor's and Supplier's responsibility to check the Government's web address for amendments.**

## **26.1 PLAN HOLDER'S LIST.**

The CD-Rom will provide a list of plan holders that have registered at the time the CD-Rom was created. It is bidder's responsibility to check for any updates to the plan holder's list, which is available at the following web address:

<http://ebs-nwo.wes.army.mil/>

## **26.2 AVAILABILITY OF BID RESULTS (Local Clause/Provision)**

Bid results will be available after bid opening on the Government's web address:

<http://ebs-nwo.wes.army.mil/>. Official bid abstracts will be available and may be requested by sending a self-addressed stamped envelope to: U.S. Army Corps of Engineers, Omaha District, ATTN: CENWO-CT-C (Jan Cook, 106 South 15th Street, Omaha, NE 68102-1618).

## **27 (FAR 52.233-2) SERVICE OF PROTEST (AUG 1996).**

(a) Protests, as defined in section 33.101 of the Federal Acquisition Regulation, that are filed directly with an agency, and copies of any protests that are filed with the General Accounting Office (GAO), shall be served on the Contracting Officer (addressed as follows) by obtaining written and dated acknowledgement of receipt from District Counsel, 106 South 15th Street, Omaha, Nebraska 68102-1618.

(b) The copy of any protest shall be received in the office designated above within one day of filing a protest with the GAO.

## **28 PRE-AWARD SURVEY INFORMATION (Local Provision) (Sep 93)**

In accordance with Paragraph PERFORMANCE AND PAYMENT BONDS, request that the following information be submitted with your bid. This facilitates the award process.

1. Financial
    - Name, address, and fax number of Financial Institution
    - Name and phone number of finance individual (primary and alternate) to be contacted for information
  2. Bonding Information
    - Provide the name, address, regular phone number and fax number of your Surety Company.
  3. Performance
    - Provide three (3) references to be contacted on your company's performance
- The following information should be submitted:  
Name and Fax number of Owner/User

Project Name, Location, Contract Number, and dollar value  
Name and phone number of individuals (primary and  
alternate) that can verify performance of the project

**29 (FAR 52.204-6) DATA UNIVERSAL NUMBERING SYSTEM (DUNS) NUMBER (JUNE 1999)**

(a) The offeror shall enter, in the block with its name and address on the cover page of its offer, the annotation "DUNS" followed by the DUNS number that identifies the offeror's name and address exactly as stated in the offer. The DUNS number is a nine-digit number assigned by Dun and Bradstreet Information Services.

(b) If the offeror does not have a DUNS number, it should contact Dun and Bradstreet directly to obtain one. A DUNS number will be provided immediately by telephone at no charge to the offeror. For information on obtaining a DUNS number, the offeror, if located within the United States, should call Dun and Bradstreet at 1-800-333-0505. The offeror should be prepared to provide the following information:

- (1) Company name.
- (2) Company address.
- (3) Company telephone number.
- (4) Line of business.
- (5) Chief executive officer/key manager.
- (6) Date the company was started.
- (7) Number of people employed by the company.
- (8) Company affiliation.

(c) Offerors located outside the United States may obtain the location and phone number of the local Dun and Bradstreet Information Services office from the Internet home page at <http://www.customerservice@dnb.com>. If an offeror is unable to locate a local service center, it may send an e-mail to Dun and Bradstreet at [globalinfo@mail.dnb.com](mailto:globalinfo@mail.dnb.com).

(End of provision)

**30 (FAR 52.216-1) TYPE OF CONTRACT (APR 1984).**

The Government contemplates award of a Firm Fixed Price contract resulting from this solicitation.

**31 SUBCONTRACTING PLAN/SUBCONTRACTING GOALS REGARDING THE UTILIZATION OF SMALL BUSINESS CONCERNS.**

- a. **Application.** This clause applies only to large business concerns

submitting bids for services exceeding \$500,000 or for construction exceeding \$1,000,000.

**b. Federal Acquisition Regulations (FAR).** Attention is directed to the following FAR provisions contained in this solicitation:

52.219-8, Utilization of Small Business Concerns (Alternate I)

52.219-9, Small Business Subcontracting Plan (Alternate I)

52.219-16, Liquidated Damages - Small Business Subcontracting Plan

52.226-1, Utilization of Indian Organizations and Indian-Owned Economic Enterprises

**c. Goals.** The U.S. Army Corps of Engineers considers the following goals reasonable and achievable for fiscal year 2002 and for the performance of the resultant contract:

(1) 57.2% of planned subcontracting dollars with small business concerns.

(2) 8.9% of planned subcontracting dollars with those small business concerns owned and controlled by socially and economically disadvantaged individuals.

(3) 8.1% of planned subcontracting dollars with those small business concerns owned and controlled by women.

(4) 3.0% of planned subcontracting dollars with those small business concerns owned and controlled by Service-Disabled Veterans.

(5) 3.0% of planned subcontracting dollars with those small business concerns owned and controlled by HubZones.

**d. Submission and Review of Subcontracting Plan.**

SUBMISSION OF SMALL BUSINESS SUBCONTRACTING PLAN IS NOT APPLICABLE TO SMALL BUSINESSES.

(1) The apparent low bidder must submit a subcontracting plan within five (5) calendar days after bid opening (a longer period maybe granted by the Contracting Officer upon request) within 24 hours after notification by the Government to the Contracting Activity.

(2) Goals included in the subcontracting plan should be at least equal to those indicated above. If lesser goals are proposed, the bidder may be required to substantiate how the proposed plan represents the bidder's best effort to comply with the terms and conditions of the solicitation. Bidders are highly encouraged to become familiar with the intent of the solicitation provisions and the elements of the subcontracting plan.

(3) The subcontracting plan must contain, as a minimum, the elements set forth in FAR provision 52.219-9. An example subcontracting plan will be furnished to the apparent low bidder (upon request). The example subcontracting plan (if requested) should not be construed as an acceptable subcontracting plan. Any format will be acceptable provided that the plan addresses each element as required by the Federal Acquisition Regulations and its supplements.

(4) Proposed plans will be reviewed by the Government to ensure the plan represents the firm's best efforts to maximize subcontracting opportunities for small, small disadvantaged and women-owned businesses.

(5) Subcontracting plans are required to be approved prior to Contract Award. The approved subcontracting plan (to include goals) will become a material part of the contract.

**e. Failing to Submit An Acceptable Subcontracting Plan.** An apparent low bidder failing to submit a subcontracting plan which demonstrates a reasonable effort to meet the goals listed above or provide an explanation why lesser goals are proposed (upon request), will be considered as non-responsive and not considered eligible for award of the contract.

**f. Questions or Assistance Needed in Developing Subcontracting Plan.** For any questions or assistance needed in developing the subcontracting plan, contact the Contract Specialist or District's Deputing for Small Business (See paragraph: BIDDER QUESTIONS AND COMMENTS, Contract Specialist [Bid Results] or the District's Deputy for Small Business [Small Business] or fax your inquiries to 402-221-4199).

### **32 (DFARS 252.204-7004) REQUIRED CENTRAL CONTRACTOR REGISTRATION (NOV 2001)**

(a) Definitions.

As used in this clause--

(1) "Central Contractor Registration (CCR database" means the primary DoD repository for contractor information required for the conduct of business with DoD.

(2) "Data Universal Numbering System (DUNS) number" means the 9-digit number assigned by Dun and Bradstreet Information Services to identify unique business entities.

(3) "Data Universal Numbering System +4 (DUNS+4) number" means the DUNS number assigned by Dun and Bradstreet plus a 4-digit suffix that may be assigned by a parent (controlling) business concern. This 4-digit suffix may be assigned at the discretion of the parent business concern for such purposes as identifying subunits or affiliates of the parent business concern.

(4) "Registered in the CCR database" means that all mandatory information, including the DUNS number or the DUNS+4 number, if applicable, and the corresponding Commercial and Government Entity (CAGE) code, is in the CCR

database; the DUNS number and the CAGE code have been validated; and all edits have been successfully completed.

(b) (1) By submission of an offer, the offeror acknowledges the requirement that a prospective awardee must be registered in the CCR database prior to award, during performance, and through final payment of any contract resulting from this solicitation, except for awards to foreign vendors for work to be performed outside the United States.

(2) The offeror shall provide its DUNS or, if applicable, its DUNS+4 number with its offer, which will be used by the Contracting Officer to verify that the offeror is registered in the CCR database.

(3) Lack of registration in the CCR database will make an offeror ineligible for award.

(4) DoD has established a goal of registering an applicant in the CCR database within 48 hours after receipt of a complete and accurate application via the Internet. However, registration of an applicant submitting an application through a method other than the Internet may take up to 30 days. Therefore, offerors that are not registered should consider applying for registration immediately upon receipt of this solicitation.

(c) The Contractor is responsible for the accuracy and completeness of the data within the CCR, and for any liability resulting from the Government's reliance on inaccurate or incomplete data. To remain registered in the CCR database after the initial registration, the Contractor is required to confirm on an annual basis that its information in the CCR database is accurate and complete.

(d) Offerors and contractors may obtain information on registration and annual confirmation requirements by calling 1-888-227-2423, or via the Internet at <http://www.ccr.gov>.

(End of clause)

## **REQUIRED CENTRAL CONTRACTOR REGISTRATION (CCR)**

**Register Now:** Don't wait until you submit an offer on a solicitation. You must be registered to receive the contract award. It can often take 30 days for CCR to process your registration information.

### **Register One of Three Ways:**

**Internet:** <http://www.ccr.gov>

**Value Added Network (VAN) for EDI users:**

Contact your VAN for information. If you need to find a VAN look at

[http://www.acq.osd.mil/ec/ecip/van\\_list.htm](http://www.acq.osd.mil/ec/ecip/van_list.htm)

**FAX or Mail:** Call (888)227-2423 or (616)961-4725 to receive a registration package. FAX or mail the completed information to the CCR Assistance Center. It can take up to 30 days to process a faxed or mailed package.

**CCR Assistance Center**

74 Washington Street North, Suite 7

Battle Creek, MI 49017-3084

FAX: (616)961-7243

SECTION 00600  
REPRESENTATIONS, CERTIFICATIONS & OTHER STATEMENTS OF BIDDERS

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SECTION 00600  
REPRESENTATIONS, CERTIFICATIONS & OTHER STATEMENTS OF BIDDERS

The bidder (offeror) makes the following certification and representations as a part of the bid, shall check the appropriate boxes, fill in the appropriate information, and provide signatures on the attached "Solicitation Form" (00600) pages, and submit with Standard Form 1442 (Section 00010).

**1. (FAR 52.203-2) CERTIFICATE OF INDEPENDENT PRICE DETERMINATION (APR 1985).**

(a) The offeror certifies that -

(1) The prices in this offer have been arrived at independently, without, for the purpose of restricting competition, any consultation, communication, or agreement with any other offeror or competitor relating to (i) those prices, (ii) the intention to submit an offer, or (iii) the methods or factors used to calculate the prices offered;

(2) the prices in this offer have not been and will not be knowingly disclosed by the offeror, directly or indirectly, to any other offeror or competitor before bid opening (in the case of a Sealed Bid solicitation) or contract award (in the case of a negotiated solicitation) unless otherwise required by law; and

(3) no attempt has been made or will be made by the offeror to induce any other concern to submit or not to submit an offer for the purpose of restricting competition.

(b) Each signature on the offer is considered to be a certification by the signatory that the signatory -

(1) is the person in the offeror's organization responsible for determining the prices being offered in this bid or proposal, and that the signatory has not participated and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) above; or

(2)(i) has been authorized, in writing, to act as agent for the following principals in certifying that those principals have not participated, and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) above

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\_\_\_\_\_ [insert full name of person(s) in the offeror's organization responsible for determining the prices offered in this bid or proposal, and the title of his or her position in the offeror's organization];

(ii) as an authorized agent, does certify that the principals named in subdivision (b)(2)(i) above have not participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) above; and

(iii) as an agent, has not personally participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) above.

(c) If the offeror deletes or modifies subparagraph (a)(2) above, the offeror must furnish with its offer a signed statement setting forth in detail the circumstances of the disclosure.

**2. (FAR 52.203-11) CERTIFICATION AND DISCLOSURE REGARDING PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS (APR 1991).**

(a) The definitions and prohibitions contained in the clause, at FAR 52.203-12, Limitation on Payments to Influence Certain Federal Transactions, included in this solicitation, are hereby incorporated by reference in paragraph (b) of this certification.

(b) The offeror, by signing its offer, hereby certifies to the best of his or her knowledge and belief that on or after December 23, 1989, -

(1) No Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on his or her behalf in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment or modification of any Federal contract, grant, loan, or cooperative agreement;

(2) If any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on his or her behalf in connection with this solicitation, the offeror shall complete and submit, with its offer, OMB standard form LLL, Disclosure of Lobbying Activities, to the Contracting Officer; and

(3) He or she will include the language of this certification in all subcontract awards at any tier and require that all recipients of subcontract awards in excess of \$100,000 shall certify and disclose accordingly.

(c) Submission of this certification and disclosure is a prerequisite for making or entering into this contract imposed by section 1352, title 31, United States Code. Any person who makes an expenditure prohibited under this provision or who fails to file or amend the disclosure form to be filed or amended by this provision, shall be subject to a civil penalty of not less than \$10,000, and not more than \$100,000, for each such failure.

**3. (FAR 52.204-3) TAXPAYER IDENTIFICATION (OCT 1998).**

(a) Definitions.

"Common parent," as used in this provision, means that corporate entity that owns or controls an affiliated group of corporations that files its Federal income tax returns on a consolidated basis, and of which the offeror is a member.

"Taxpayer Identification Number (TIN)," as used in this provision, means the number required by the Internal Revenue Service (IRS) to be used by the offeror in reporting income tax and other returns. The TIN may be either a Social Security Number or an Employer Identification Number.

(b) All offerors must submit the information required in paragraphs (d) through (f) of this provision to comply with debt collection requirements of 31 U.S.C. 7701(c) and 3325(d), reporting requirements of 26 U.S.C. 6041, 6041A, and 6050M, and implementing regulations issued by the IRS. If the resulting contract is subject to the payment reporting requirements described in Federal Acquisition Regulation (FAR) 4.904, the failure or refusal by the offeror to furnish the information may result in a 31 percent reduction of payments otherwise due under the contract.

(c) The TIN may be used by the Government to collect and report on any delinquent amounts arising out of the offeror's relationship with the Government (31 U.S.C. 7701(c)(3)). If the resulting contract is subject to the payment reporting requirements described in FAR 4.904, the TIN provided hereunder may be matched with IRS records to verify the accuracy of the offeror's TIN.

(d) Taxpayer Identification Number (TIN).

TIN: \_\_\_\_\_.

TIN has been applied for.

TIN is not required because:

Offeror is a nonresident alien, foreign corporation, or foreign partnership that does not have income effectively connected with the conduct of a trade or business in the United States and does not have an office or place of business or a fiscal paying agent in the United States;

Offeror is an agency or instrumentality of a foreign government;

Offeror is an agency or instrumentality of the Federal Government.

(e) Type of organization.

Sole proprietorship;

Partnership;

Corporate entity (not tax-exempt);

Corporate entity (tax-exempt);

Government entity (Federal, State, or local);

Foreign government;

International organization per 26 CFR 1.6049-4;

Other \_\_\_\_\_.

(f) Common parent.

Offeror is not owned or controlled by a common parent as defined in paragraph (a) of this provision.

Name and TIN of common parent:

Name \_\_\_\_\_

TIN \_\_\_\_\_

(End of provision)

**4. (FAR 52.204-5) WOMEN-OWNED BUSINESS (OTHER THAN SMALL BUSINESS)**  
**[MAY 1999]**

(a) *Definition.* Women-owned business concern, as used in this provision, means a concern that is

at least 51 percent owned by one or more women; or in the case of any publicly owned business, at least 51 percent of its stock is owned by one or more women; and whose management and daily business operations are controlled by one or more women.

(b) *Representation.* [Complete only if the offeror is a women-owned business concern and has not represented itself as a small business concern in paragraph (b)(1) of FAR 52.219-1, *Small Business Program Representations, of this solicitation.*] The offeror represents that it [ ] is a women-owned business concern.

(End of provision)

**5. (DFARS 252.204-7001) COMMERCIAL AND GOVERNMENT ENTITY (CAGE) CODE REPORTING (AUG 1999).**

(a) The offeror is requested to enter its CAGE code on its offer in the block with its name and address. The CAGE code entered must be for that name and address. Enter “CAGE” before the number.

(b) If the offeror does not have a CAGE code, it may ask the Contracting Officer to request one from the Defense Logistics Information Service (DLIS). The Contracting Officer will-

(1) Ask the Contractor to complete section B of a DD Form 2051, Request for Assignment of a Commercial and Government Entity (CAGE) Code;

(2) Complete section A and forward the form to DLIS; and

(3) Notify the Contractor of its assigned CAGE code.

(c) Do not delay submission of the offer pending receipt of a CAGE code.

**6. (FAR 52.209-5) CERTIFICATION REGARDING DEBARMENT, SUSPENSION, PROPOSED DEBARMENT, AND OTHER RESPONSIBILITY MATTERS (DEC 2001).**

(a)(1) The Offeror certifies, to the best of its knowledge and belief, that—

(i) The Offeror and/or any of its Principals—

(A) Are [ ] are not [ ] presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any Federal agency;

(B) Have [ ] have not [ ], within a three-year period preceding this offer, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, state, or local) contract or subcontract; violation of Federal or state antitrust statutes relating to the submission of offers; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, or receiving stolen property; and

(C) Are [ ] are not [ ] presently indicted for, or otherwise criminally or civilly charged by a governmental entity with, commission of any of the offenses enumerated in paragraph (a)(1)(i)(B) of this provision.

(ii) The Offeror has [ ] has not [ ], within a three-year period preceding this offer, had one or more contracts terminated for default by any Federal agency.

(2) “Principals,” for the purposes of this certification, means officers; directors; owners; partners; and, persons having primary management or supervisory responsibilities within a business entity (e.g., general manager; plant manager; head of a subsidiary, division, or business segment, and similar positions).

This Certification Concerns a Matter Within the Jurisdiction of an Agency of the United States and the Making of a False, Fictitious, or Fraudulent Certification May Render the Maker Subject

to Prosecution Under Section 1001, Title 18, United States Code.

(b) The Offeror shall provide immediate written notice to the Contracting Officer if, at any time prior to contract award, the Offeror learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

(c) A certification that any of the items in paragraph (a) of this provision exists will not necessarily result in withholding of an award under this solicitation. However, the certification will be considered in connection with a determination of the Offeror's responsibility. Failure of the Offeror to furnish a certification or provide such additional information as requested by the Contracting Officer may render the Offeror nonresponsible.

(d) Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by paragraph (a) of this provision. The knowledge and information of an Offeror is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

(e) The certification in paragraph (a) of this provision is a material representation of fact upon which reliance was placed when making award. If it is later determined that the Offeror knowingly rendered an erroneous certification, in addition to other remedies available to the Government, the Contracting Officer may terminate the contract resulting from this solicitation for default. (End of Provision)

**7. (DFARS 252.209-7001) DISCLOSURE OF OWNERSHIP OR CONTROL BY A FOREIGN GOVERNMENT THAT SUPPORTS TERRORISM (MAR 1998). [For Contracts exceeding \$100,000]**

(a) Definitions.

As used in this provision-

(1) "Government of a terrorist country" includes the state and the government of a terrorist country, as well as any political subdivision, agency, or instrumentality thereof.

(2) "Terrorist country" means a country determined by the Secretary of State, under section 6(j)(1)(A) of the Export Administration Act of 1979 (50 U.S.C. App. 2405(j)(i)(A)), to be a country the government of which has repeatedly provided support for acts of international terrorism. As of the date of this provision, terrorist countries include: Cuba, Iran, Iraq, Libya, North Korea, Sudan, and Syria.

(3) "Significant interest" means-

(i) Ownership of or beneficial interest in 5 percent or more of the firm's or subsidiary's securities. Beneficial interest includes holding 5 percent or more of any class of the firm's securities in "nominee shares," "street names," or some other method of holding securities that does not disclose the beneficial owner;

(ii) Holding a management position in the firm, such as a director or officer;

(iii) Ability to control or influence the election, appointment, or tenure of directors or officers in the firm;

(iv) Ownership of 10 percent or more of the assets of a firm such as equipment, buildings, real estate, or other tangible assets of the firm; or

(v) Holding 50 percent or more of the indebtedness of a firm.

(b) Prohibition on award. In accordance with 10 U.S.C. 2327, no contract may be awarded to a firm or a subsidiary of a firm if the government of a terrorist country has a significant interest in the firm or subsidiary [or, in the case of a subsidiary, the firm that owns the subsidiary], unless a waiver is granted by the Secretary of Defense.

(c) Disclosure.

The Offeror shall disclose any significant interest the government of each of the following countries has in the Offeror or a subsidiary of the Offeror. If the Offeror is a subsidiary, it shall also disclose any significant interest the government of a terrorist country has in any firm that owns or controls the subsidiary. The disclosure shall include--

- (1) Identification of each government holding a significant interest; and
- (2) A description of the significant interest held by each Government.

(End of provision)

**8. (FAR 52.211-6) BRAND NAME OR EQUAL (AUG 1999).**

(a) If an item in this solicitation is identified as "brand name or equal," the purchase description reflects the characteristics and level of quality that will satisfy the Government's needs. The salient physical, functional, and other characteristics that "equal" products must meet are specified in the solicitation.

(b) To be considered for award, offers of "equal" products, including "equal" products of the brand name manufacturer, must--

(1) Meet the salient physical, functional, and other characteristics specified in the solicitation;

(2) Clearly identify the item by--

(i) Brand name, if any; and

(ii) Make or model number;

(3) Include descriptive literature such as cuts, illustrations, drawings, or a clear reference to previously furnished descriptive data or information available to the Contracting Officer; and

(4) Clearly describe any modifications the offeror plans to make in a product to make it conform to the solicitation requirements. Mark any descriptive material to clearly show the modifications.

(c) The Contracting Officer will evaluate "equal" products on the basis of information by the offeror or identified in the offer and reasonably available to the Contracting Officer. The Contracting Officer is not responsible for locating or securing any information not identified in the offer.

(d) Unless the offeror clearly indicates in its offer that the product being offered is an "equal" product, the offeror shall provide the brand name product referenced in the solicitation.

**9. RESERVED**

**10. RESERVED**

**11. (FAR 52.219-1) SMALL BUSINESS PROGRAM REPRESENTATIONS (APR 2002)  
ALTERNATE I (APR 2002)**

(a)(1) The North American Industry Classification System (NAICS) code for this acquisition is \_\_\_\_\_ [*insert NAICS code*].

(2) The small business size standard is \_\_\_\_\_ [*insert size standard*].

(3) The small business size standard for a concern which submits an offer in its own name, other than on a construction or service contract, but which proposes to furnish a product which it did not itself manufacture, is 500 employees.

(b) *Representations.* (1) The offeror represents as part of its offer that it [ ] is, [ ] is not a small

business concern.

(2) [Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.] The offeror represents, for general statistical purposes, that it [ ] is, [ ] is not, a small disadvantaged business concern as defined in 13 CFR 124.1002.

(3) [Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.] The offeror represents as part of its offer that it [ ] is, [ ] is not a women-owned small business concern.

(4) [Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.] The offeror represents as part of its offer that it [ ] is, [ ] is not a veteran-owned small business concern.

(5) [Complete only if the offeror represented itself as a veteran-owned small business concern in paragraph (b)(4) of this provision.] The offeror represents as part of its offer that it [ ] is, [ ] is not a service-disabled veteran-owned small business concern.

(6) [Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.] The offeror represents, as part of its offer, that—

(i) It [ ] is, [ ] is not a HUBZone small business concern listed, on the date of this representation, on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration, and no material change in ownership and control, principal office, or HUBZone employee percentage has occurred since it was certified by the Small Business Administration in accordance with 13 CFR part 126; and

(ii) It [ ] is, [ ] is not a joint venture that complies with the requirements of 13 CFR part 126, and the representation in paragraph (b)(6)(i) of this provision is accurate for the HUBZone small business concern or concerns that are participating in the joint venture. [The offeror shall enter the name or names of the HUBZone small business concern or concerns that are participating in the joint venture:\_\_\_\_\_.] Each HUBZone small business concern participating in the joint venture shall submit a separate signed copy of the HUBZone representation.

(7) [Complete if offeror represented itself as disadvantaged in paragraph (b)(2) of this provision.]

The offeror shall check the category in which its ownership falls:

\_\_\_\_\_ Black American.

\_\_\_\_\_ Hispanic American.

\_\_\_\_\_ Native American (American Indians, Eskimos, Aleuts, or Native Hawaiians).

\_\_\_\_\_ Asian-Pacific American (persons with origins from Burma, Thailand, Malaysia, Indonesia, Singapore, Brunei, Japan, China, Taiwan, Laos, Cambodia (Kampuchea), Vietnam, Korea, The Philippines, U.S. Trust Territory of the Pacific Islands (Republic of Palau), Republic of the Marshall Islands, Federated States of Micronesia, the Commonwealth of the Northern Mariana Islands, Guam, Samoa, Macao, Hong Kong, Fiji, Tonga, Kiribati, Tuvalu, or Nauru).

\_\_\_\_\_ Subcontinent Asian (Asian-Indian) American (persons with origins from India, Pakistan, Bangladesh, Sri Lanka, Bhutan, the Maldives Islands, or Nepal).

\_\_\_\_\_ Individual/concern, other than one of the preceding.

(c) *Definitions.* As used in this provision—

“Service-disabled veteran-owned small business concern”—

(1) Means a small business concern—

(i) Not less than 51 percent of which is owned by one or more service-disabled veterans or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more service-disabled veterans; and

(ii) The management and daily business operations of which are controlled by one or more service-disabled veterans or, in the case of a veteran with permanent and severe disability, the spouse or permanent caregiver of such veteran.

(2) Service-disabled veteran means a veteran, as defined in 38 U.S.C. 101(2), with a disability that is service connected, as defined in 38 U.S.C. 101(16).

“Small business concern” means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the criteria in 13 CFR part 121 and the size standard in paragraph (a) of this provision.

“Veteran-owned small business concern” means a small business concern—

(1) Not less than 51 percent of which is owned by one or more veterans (as defined at 38 U.S.C. 101(2)) or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more veterans; and

(2) The management and daily business operations of which are controlled by one or more veterans.

“Women-owned small business concern” means a small business concern—

(1) That is at least 51 percent owned by one or more women; or, in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and

(2) Whose management and daily business operations are controlled by one or more women.

(d) *Notice.* (1) If this solicitation is for supplies and has been set aside, in whole or in part, for small business concerns, then the clause in this solicitation providing notice of the set-aside contains restrictions on the source of the end items to be furnished.

(2) Under 15 U.S.C. 645(d), any person who misrepresents a firm's status as a small, HUBZone small, small disadvantaged, or women-owned small business concern in order to obtain a contract to be awarded under the preference programs established pursuant to section 8(a), 8(d), 9, or 15 of the Small Business Act or any other provision of Federal law that specifically references section 8(d) for a definition of program eligibility, shall—

(i) Be punished by imposition of fine, imprisonment, or both;

(ii) Be subject to administrative remedies, including suspension and debarment;

and

(iii) Be ineligible for participation in programs conducted under the authority of

the Act.

(End of provision)

## **12. (FAR 52.219-2) EQUAL LOW BIDS (OCT 1995)**

(a) This provision applies to small business concerns only.

(b) The bidder's status as a labor surplus area (LSA) concern may affect entitlement to award in case of tie bids. If the bidder wishes to be considered for this priority, the bidder must identify, in the following space, the LSA in which the costs to be incurred on account of manufacturing or production (by the bidder or the first-tier subcontractors) amount to more than 50 percent of the contract price.

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(c) Failure to identify the labor surplus areas as specified in paragraph (b) of this provision will preclude the bidder from receiving priority consideration. If the bidder is awarded a contract as a result of receiving priority consideration under this provision and would not have otherwise received award, the bidder shall perform the contract or cause the contract to be performed in accordance with the obligations of an LSA concern.

## **13. RESERVED**

## **14. (FARS 52.219-19) SMALL BUSINESS CONCERN REPRESENTATION FOR THE SMALL BUSINESS COMPETITIVENESS DEMONSTRATION PROGRAM (OCT 2000).**

(a) *Definition.* “Emerging small business” as used in this solicitation, means a small business concern whose size is no greater than 50 percent of the numerical size standard applicable to the North American Industry Classification System (NAICS) code assigned to a contracting opportunity.

(b) (Complete only if Offeror has represented itself under the provision at FAR 52.219-1 as a small business concern under the size standards of this solicitation.) The Offeror [ ] is, [ ] is not an emerging small business.

(c) (Complete only if the Offeror is a small business or an emerging small business, indicating its size range.)

Offeror's number of employees for the past 12 months (check this column if size standard stated in solicitation is expressed in terms of number of employees) or Offeror's average annual gross revenue for the last 3 fiscal years (check this column if size standard stated in solicitation is expressed in terms of annual receipts). (Check one of the following.)

No. of Employees	Average Annual Gross Revenues
____ 50 or fewer	____ \$1 million or less
____ 51 - 100	____ \$1,000,001 - \$2 million
____ 101 - 250	____ \$2,000,001 - \$3.5 million
____ 251 - 500	____ \$3,500,001 - \$5 million
____ 501 - 750	____ \$5,000,001 - \$10 million
____ 751 - 1,000	____ \$10,000,001 - \$17 million
____ Over 1,000	____ Over \$17 million

**15. (FARS 52.219-21) SMALL BUSINESS SIZE REPRESENTATION FOR TARGETED INDUSTRY CATEGORIES UNDER THE SMALL BUSINESS COMPETITIVENESS DEMONSTRATION PROGRAM (MAY 1999).**

*[Complete only if the Offeror has represented itself under the provision at 52.219-1 as a small business concern under the size standards of this solicitation.]*

Offeror's number of employees for the past 12 months *[check this column if size standard stated in solicitation is expressed in terms of number of employees]* or Offeror's average annual gross revenue for the last 3 fiscal years *[check this column if size standard in solicitation is expressed in terms of annual receipts]*. *[Check one of the following.]*

No. of Employees	Average Annual Gross Revenues
____ 50 or fewer	____ \$1 million or less
____ 51 - 100	____ \$1,000,001 - \$2 million
____ 101 - 250	____ \$2,000,001 - \$3.5 million
____ 251 - 500	____ \$3,500,001 - \$5 million
____ 501 - 750	____ \$5,000,001 - \$10 million
____ 751 - 1,000	____ \$10,000,001 - \$17 million
____ Over 1,000	____ Over \$17 million

**16. (FAR 52.222-21)**

**CERTIFICATION OF NONSEGREGATED FACILITIES (FEB 1999)**

(a) "Segregated facilities," as used in this clause, means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees, that are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, sex, or national origin because of written or oral policies or employee custom. The term does not include separate or single-user rest rooms or necessary dressing or sleeping areas provided to assure privacy between the sexes.

(b) The Contractor agrees that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The Contractor agrees that a breach of this clause is a violation of the Equal Opportunity clause in this contract.

(c) The Contractor shall include this clause in every subcontract and purchase order that is subject to the Equal Opportunity clause of this contract.  
(End of clause)

**17. (FAR 52.222-22) PREVIOUS CONTRACTS AND COMPLIANCE REPORTS (FEB 1999).**

The offeror represents that—

(a) It  has,  has not participated in a previous contract or subcontract subject the Equal Opportunity clause of this solicitation;

(b) It  has,  has not filed all required compliance reports; and

(c) Representations indicating submission of required compliance reports, signed by proposed subcontractors, will be obtained before subcontract awards.  
(End of provision)

**18. (FAR 52.223-4) RECOVERED MATERIAL CERTIFICATION (OCT 1997)**

As required by the Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6962(c)(3)(A)(i)), the offeror certifies, by signing this offer, that the percentage of recovered materials to be used in the performance of the contract will be at least the amount required by the applicable contract specifications.  
(End of provision)

**19. (FAR 52.223-13) CERTIFICATION OF TOXIC CHEMICAL RELEASE REPORTING (OCT 2000) [For Contracts over \$100,000]**

(a) Submission of this certification is a prerequisite for making or entering into this contract imposed by Executive Order 12969, August 8, 1995.

(b) By signing this offer, the offeror certifies that-

(1) As the owner or operator of a facilities that will be used in the performance of this contract that are subject to the filing and reporting requirements described in section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11023) and section 6607 of the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13106), the offeror will file and continue to file, for such facilities for the life of the contract the Toxic Chemical Release Inventory Form (Form R) as described in sections 313(a) and (g) of the EPCRA and section 6607 of PPA; or

(2) None of its owned or operated facilities to be used in the performance of this contract is subject the Form R filing and reporting requirements because each facility is exempt for at least one of the following reasons: (Check each block that is applicable.)

(i) The facility does not manufacture, process or otherwise use any toxic chemicals listed under section 313(c) of EPCRA, 42 U.S.C. 11023(c);

(ii) The facility does not have 10 or more full-time employees as specified in section 313(b)(1)(A) of EPCRA, 42 U.S.C. 11023(b)(1)(A);

(iii) The facility does not meet the reporting thresholds of toxic chemicals established under section 313(f) of EPCRA, 42 U.S.C. 11023(f) (including the alternate thresholds at 40 CFR 372.27, provided an appropriate certification form has been filed with EPA);

(iv) The facility does not fall within Standard Industrial Classification Code (SIC) major groups 20 through 39 or their corresponding North American Industry Classification System (NAICS) sectors 31 through 33; or

(v) The facility is not located within any State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, American Samoa, the United States Virgin Islands, the Northern Mariana Islands, or any other territory or possession over which the United States has jurisdiction.

**20. (DFARS 252.225-7031) SECONDARY ARAB BOYCOTT OF ISRAEL (JUN 1992)**

(a) Definitions. As used in this clause--

(1) "Foreign person" means any person other than a United States person as defined in Section 16(2) of the Export Administration Act of 1979 (50 U.S.C. App. Sec 2415).

(2) "United States person" is defined in Section 16(2) of the Export Administration Act of 1979 and means any United States resident or national (other than an individual resident outside the United States and employed by other than a United States person), any domestic concern (including any permanent domestic establishment of any foreign concern), and any foreign subsidiary or affiliate (including any foreign establishment) of any domestic concern which is controlled in fact by such domestic concern, as determined under regulations of the President.

(b) Certification.

By submitting this offer, the Offeror, if a foreign person, company, company or entity, certifies that it--

(1) Does not comply with the Secondary Arab Boycott of Israel; and

(2) Is not taking or knowingly agreeing to take any action, with respect to the Secondary Boycott of Israel by Arab countries, which 50 U.S.C. App. Sec 2407(a) prohibits a United States person from taking.

(End of clause)

**21. (DFARS 252.247-7022) REPRESENTATION OF EXTENT OF TRANSPORTATION BY SEA (AUG 1992).**

(a) The Offeror shall indicate by checking the appropriate blank in paragraph (b) of this provision whether transportation of supplies by sea is anticipated under the resultant contract. The term "supplies" is defined in the Transportation of Supplies by Sea clause of this solicitation.

(b) REPRESENTATION. The Offeror represents that it-

\_\_\_\_\_ Does anticipate that supplies will be transported by sea in the performance of any contract or subcontract resulting from this solicitation.

\_\_\_\_\_ Does not anticipate that supplies will be transported by sea in the performance of any contract or subcontract resulting from this solicitation.

(c) Any contract resulting from this solicitation will include the Transportation of Supplies by Sea Clause. If the Offeror represents that it will not use ocean transportation, the resulting contract will also include the Defense FAR Supplement clause at 252.247-7024, Notification of Transportation of Supplies by Sea.

SECTION 00700

CONTRACT CLAUSES

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47. \*FAR 52.222-36 AFFIRMATIVE ACTION FOR WORKERS WITH DISABILITIES (JUN 1998)
48. \*FAR 52.222-37 EMPLOYMENT REPORTS ON SPECIAL DISABLED VETERANS, VETERANS OF THE VIETNAM ERA, AND OTHER ELIGIBLE VETERANS (DEC 2001)
49. \*FAR 52.222-38 COMPLIANCE WITH VETERANS' EMPLOYMENT REPORTING REQUIREMENTS (DEC 2001)
50. \*FAR 52.223-5 POLLUTION PREVENTION AND RIGHT-TO-KNOW INFORMATION (APR 1998) [For Work on Federal Facilities]
51. \*FAR 52.223-6 DRUG-FREE WORKPLACE (MAY 2001)
52. FAR 52.223-9 ESTIMATE OF PERCENTAGE OF RECOVERED MATERIAL CONTENT FOR EPA-DESIGNATED PRODUCTS (AUG 2000) [For Contracts exceeding \$100,000. EPA Designated product (available at <http://www.epa.gov/cpg/>)]
53. \*FAR 52.223-14 TOXIC CHEMICAL RELEASE REPORTING (OCT 2000) [For Contracts Over \$100,000]
54. RESERVED
55. DFARS 252.223-7006 PROHIBITION ON STORAGE AND DISPOSAL OF TOXIC AND HAZARDOUS MATERIALS (APR 1993)
56. \*FAR 52.225-9 BUY AMERICAN ACT—CONSTRUCTION MATERIALS (MAY 2002) (For Contracts less than \$6.481 million)
57. \*FAR 52.225-10 NOTICE OF BUY AMERICAN ACT REQUIREMENT—CONSTRUCTION MATERIALS (MAY 2002) (Applicable with FAR 52.225-9)
58. \*FAR 52.225-11 BUY AMERICAN ACT—CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS (JULY 2002) [For Contracts more than \$6,481,000] ALTERNATE I (MAY 2002) [For Contracts between \$6.481 and 7.304733 Million]
59. \*FAR 52.225-12 NOTICE OF BUY AMERICAN ACT REQUIREMENT—CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS (MAY 2002) [Applicable with FAR 52.225-11] ALTERNATE II (MAY 2002) [For Contracts Between 6.481 and 7.344733 Million]
60. \*FAR 52.225-13 RESTRICTIONS ON CERTAIN FOREIGN PURCHASES (JULY 2000)

61. \*FAR 52.226-1 UTILIZATION OF INDIAN ORGANIZATIONS AND INDIAN-OWNED ECONOMIC ENTERPRISES (JUNE 2000)
62. \*FAR 52.227-1 AUTHORIZATION AND CONSENT (JUL 1995)
63. \*FAR 52.227-2 NOTICE AND ASSISTANCE REGARDING PATENT AND COPYRIGHT INFRINGEMENT (AUG 1996)
64. \*FAR 52.227-4 PATENT INDEMNITY--CONSTRUCTION CONTRACTS (APR 1984)
65. DFARS 252.227-7033 RIGHTS IN SHOP DRAWINGS (APR 1966)
66. FAR 52.228-1 BID GUARANTEE (SEP 1996) [NOTE: Not required for projects less than \$100,000]
67. \*FAR 52.228-2 ADDITIONAL BOND SECURITY (OCT 1997)
68. \*FAR 52.228-5 INSURANCE--WORK ON A GOVERNMENT INSTALLATION (JAN 1997) [For Contracts Exceeding \$100,000]
69. \*FAR 52.228-11 PLEDGES OF ASSETS (FEB 1992)
70. \*FAR 52.228-12 PROSPECTIVE SUBCONTRACTOR REQUESTS FOR BONDS (OCT 1995)
71. FAR 52.228-13 ALTERNATIVE PAYMENT PROTECTIONS (JULY 2000) [Applicable only for projects or delivery orders less than \$100,000]
72. FAR 52.228-14 IRREVOCABLE LETTER OF CREDIT (DEC 1999)
73. FAR 52.228-15 PERFORMANCE AND PAYMENT BONDS (JULY 2000).
74. FAR 52.229-3 FEDERAL, STATE, AND LOCAL TAXES (APR 2003) [For Contracts Exceeding \$100,000]
75. RESERVED
76. DFARS 252.231-7000 SUPPLEMENTAL COST PRINCIPLES (DEC 1991)
77. \*FAR 52.232-5 PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS (SEPT 2002)
78. RESERVED.
79. \*FAR 52.232-17 INTEREST (JUN 1996)
80. \*FAR 52.232-23 ASSIGNMENT OF CLAIMS (JAN 1986)
81. \*FAR 52.232-27 PROMPT PAY FOR CONSTRUCTION CONTRACTS (FEB 2002)
82. \*FAR 52.232-33 PAYMENT BY ELECTRONIC FUNDS TRANSFER --CENTRAL CONTRACTOR REGISTRATION (MAY 1999)
83. DFARS 252.232-7004 DOD PROGRESS PAYMENT RATES (OCT 2001)
84. DFARS 252.232-7005 REIMBURSEMENT OF SUBCONTRACTOR ADVANCE PAYMENTS--DOD PILOT MENTOR-PROTEGE PROGRAM (SEP 2001)
85. \*FAR 52.233-1 DISPUTES (JULY 2002)
86. \*FAR 52.233-3 PROTEST AFTER AWARD (AUG 1996)
87. RESERVED
88. FAR 52.236-2 DIFFERING SITE CONDITIONS (APR 1984)
89. \*FAR 52.236-3 SITE INVESTIGATION AND CONDITIONS AFFECTING THE WORK (APR 1984)
90. \*FAR 52.236-5 MATERIAL AND WORKMANSHIP (APR 1984)
91. RESERVED
92. \*FAR 52.236-6 SUPERINTENDENCE BY THE CONTRACTOR (APR 1984)
93. FAR 52.236-7 PERMITS AND RESPONSIBILITIES (NOV 1991)
94. \*FAR 52.236-8 OTHER CONTRACTS (APR 1984)
95. \*FAR 52.236-9 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS (APR 1984)
96. \*FAR 52.236-10 OPERATIONS AND STORAGE AREAS (APR 1984)
97. \*FAR 52.236-11 USE AND POSSESSION PRIOR TO COMPLETION (APR 1984)
98. \*FAR 52.236-12 CLEANING UP (APR 1984)
99. \*FAR 52.236-13 ACCIDENT PREVENTION-ALTERNATE I (NOV 1991)
100. \*FAR 52.236-14 AVAILABILITY AND USE OF UTILITY SERVICES (APR 1984)
101. FAR 52.236-15 SCHEDULES FOR CONSTRUCTION CONTRACTS (APR 1984)
102. \*FAR 52.236-17 LAYOUT OF WORK (APR 1984)
103. FAR 52.236-21 SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FEB 1997)
104. \*FAR 52.236-26 PRECONSTRUCTION CONFERENCE (FEB 1995)
105. DFARS 252.236-7000 MODIFICATION OF PROPOSALS - PRICE BREAKDOWN (DEC 1991)
106. DFARS 252.236-7008 CONTRACT PRICES - BIDDING SCHEDULES (DEC 1991)

107. \*FAR 52.242-13 BANKRUPTCY (JUL 1995)
108. \*FAR 52.242-14 SUSPENSION OF WORK (APR 1984)
109. FAR 52.243-4 CHANGES (AUG 1987)
110. DFARS 252.243-7001 PRICING OF CONTRACT MODIFICATIONS (DEC 1991)
111. DFARS 252.243-7002 REQUESTS FOR EQUITABLE ADJUSTMENT (MAR 1998)
112. \*FAR 52.244-2 SUBCONTRACTS (AUG 1998)
113. FAR 52.244-6 SUBCONTRACTS FOR COMMERCIAL ITEMS (MAY 2002)
114. \*FAR 52.245-2 GOVERNMENT PROPERTY (FIXED-PRICE CONTRACTS) (DEC 1989) [For Government Property over \$100,000]
115. \*FAR 52.245-4 GOVERNMENT-FURNISHED PROPERTY (SHORT FORM) (APR 1984) [For Government Property \$100,000 or Less]
116. \*FAR 52.246-12 INSPECTION OF CONSTRUCTION (AUG 1996)
117. \*FAR 52.246-21 WARRANTY OF CONSTRUCTION (MAR 1994)
118. DFARS 252.247-7023 TRANSPORTATION OF SUPPLIES BY SEA (MAR 2000)
119. DFARS 252.247-7024 NOTIFICATION OF TRANSPORTATION OF SUPPLIES BY SEA (MAR 2000)
120. FAR 52.248-3 VALUE ENGINEERING--CONSTRUCTION (FEB 2000) (ALTERNATE I (APR 1984)
121. \*FAR 52.249-1 TERMINATION FOR CONVENIENCE OF THE GOVERNMENT (FIXED-PRICE) (SHORT FORM) (APR 1984) [For Contracts \$100,000 or Less]
122. \*FAR 52.249-2 TERMINATION FOR CONVENIENCE OF THE GOVERNMENT (FIXED-PRICE) ALTERNATE I (SEP 1996) [For Contracts Over \$100,000]
123. \*FAR 52.249-10 DEFAULT (FIXED-PRICE CONSTRUCTION) (APR 1984)
124. ENVIRONMENTAL LITIGATION (1974 NOV OCE)
125. EFARS 52.249-5000 BASIS FOR SETTLEMENT OF PROPOSALS
126. INAPPLICABLE PROVISIONS AND CLAUSES (Local Provision). [Applicable only for projects or delivery orders less than \$100,000]

SECTION 00700

CONTRACT CLAUSES

**1. FAR 52.252-2 CLAUSES INCORPORATED BY REFERENCE (FEB 1998)**

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this/these address(es):

<http://www.arnet.gov/far>

(End of clause)

\* - CONTRACT CLAUSES THAT MAY BE INCORPORATED BY REFERENCE

**2. DFARS 252.201-7000 CONTRACTING OFFICER'S REPRESENTATIVE (DEC 1991)**

(a) Definition.

"Contracting officer's representative" means an individual designated in accordance with subsection 201.602-2 of the Defense Federal Acquisition Regulation Supplement and authorized in writing by the contracting officer to perform specific technical or administrative functions.

(b) If the Contracting Officer designates a contracting officer's representative (COR), the Contractor will receive a copy of the written designation. It will specify the extent of the COR's authority to act on behalf of the contracting officer. The COR is not authorized to make any commitments or changes that will affect price, quality, quantity, delivery, or any other term or condition of the contract.

(End of clause)

**3. \*FAR 52.202-1 DEFINITIONS (DEC 2001) ALTERNATE I (MAY 2001)**

a) "Agency head" or "head of the agency" means the Secretary (Attorney General, Administrator, Governor, Chairperson, or other chief official, as appropriate) of the agency, unless otherwise indicated, including any deputy or assistant chief official of the executive agency.

(b) "Commercial component" means any component that is a commercial item.

(c) "Commercial item" means—

(1) Any item, other than real property, that is of a type customarily used by the general public or by non-governmental entities for purposes other than governmental purposes, and that—

(i) Has been sold, leased, or licensed to the general public; or

(ii) Has been offered for sale, lease, or license to the general public;

(2) Any item that evolved from an item described in paragraph (c)(1) of this clause through advances in technology or performance and that is not yet available in the commercial marketplace, but will be available in the commercial marketplace in time to satisfy the delivery requirements under a Government solicitation;

(3) Any item that would satisfy a criterion expressed in paragraphs (c)(1) or (c)(2) of this clause, but for—

(i) Modifications of a type customarily available in the commercial marketplace; or

(ii) Minor modifications of a type not customarily available in the commercial marketplace made to meet Federal Government requirements. "Minor" modifications means modifications that do not significantly alter the nongovernmental function or essential physical characteristics of an item or component, or

change the purpose of a process. Factors to be considered in determining whether a modification is minor include the value and size of the modification and the comparative value and size of the final product. Dollar values and percentages may be used as guideposts, but are not conclusive evidence that a modification is minor;

(4) Any combination of items meeting the requirements of paragraphs (c)(1), (2), (3), or (5) of this clause that are of a type customarily combined and sold in combination to the general public;

(5) Installation services, maintenance services, repair services, training services, and other services if—

(i) Such services are procured for support of an item referred to in paragraph (c)(1), (2), (3), or (4) of this definition, regardless of whether such services are provided by the same source or at the same time as the item; and

(ii) The source of such services provides similar services contemporaneously to the general public under terms and conditions similar to those offered to the Federal Government

(6) Services of a type offered and sold competitively in substantial quantities in the commercial marketplace based on established catalog or market prices for specific tasks performed under standard commercial terms and conditions. This does not include services that are sold based on hourly rates without an established catalog or market price for a specific service performed. For purposes of these services—

(i) “Catalog price” means a price included in a catalog, price list, schedule, or other form that is regularly maintained by the manufacturer or vendor, is either published or otherwise available for inspection by customers, and states prices at which sales are currently, or were last, made to a significant number of buyers constituting the general public; and

(ii) “Market prices” means current prices that are established in the course of ordinary trade between buyers and sellers free to bargain and that can be substantiated through competition or from sources independent of the offerors.

(7) Any item, combination of items, or service referred to in paragraphs (c)(1) through (c)(6), notwithstanding the fact that the item, combination of items, or service is transferred between or among separate divisions, subsidiaries, or affiliates of a Contractor; or

(8) A nondevelopmental item, if the procuring agency determines the item was developed exclusively at private expense and sold in substantial quantities, on a competitive basis, to multiple State and local Governments.

(d) “Component” means any item supplied to the Government as part of an end item or of another component, except that for use in 52.225-9, and 52.225-11 see the definitions in 52.225-9(a) and 52.225-11(a).

(e) “Contracting Officer” means a person with the authority to enter into, administer, and/or terminate contracts and make related determinations and findings. The term includes certain authorized representatives of the Contracting Officer acting within the limits of their authority as delegated by the Contracting Officer.

(f) “Nondevelopmental item” means—

(1) Any previously developed item of supply used exclusively for governmental purposes by a Federal agency, a State or local government, or a foreign government with which the United States has a mutual defense cooperation agreement;

(2) Any item described in paragraph (f)(1) of this definition that requires only minor modification or modifications of a type customarily available in the commercial marketplace in order to meet the requirements of the procuring department or agency; or

(3) Any item of supply being produced that does not meet the requirements of paragraph (f)(1) or (f)(2) solely because the item is not yet in use.

(End of clause)

#### **4. \*FAR 52.203-3 GRATUITIES (APR 1984)**

(a) The right of the Contractor to proceed may be terminated by written notice if, after notice and hearing, the agency head or a designee determines that the Contractor, its agent, or another representative--

(1) Offered or gave a gratuity (e.g., an entertainment or gift) to an officer, official, or employee of the Government; and

(2) Intended, by the gratuity, to obtain a contract or favorable treatment under a contract.

- (b) The facts supporting this determination may be reviewed by any court having lawful jurisdiction.
- (c) If this contract is terminated under paragraph (a) above, the Government is entitled--
  - (1) To pursue the same remedies as in a breach of the contract; and
  - (2) In addition to any other damages provided by law, to exemplary damages of not less than 3 nor more than 10 times the cost incurred by the Contractor in giving gratuities to the person concerned, as determined by the agency head or a designee. (This subparagraph (c)(2) is applicable only if this contract uses money appropriated to the Department of Defense.)
- (d) The rights and remedies of the Government provided in this clause shall not be exclusive and are in addition to any other rights and remedies provided by law or under this contract.

**5. \*FAR 52.203-5 COVENANT AGAINST CONTINGENT FEES (APR 1984)**

(a) The Contractor warrants that no person or agency has been employed or retained to solicit or obtain this contract upon an agreement or understanding for a contingent fee, except a bona fide employee or agency. For breach or violation of this warranty, the Government shall have the right to annul this contract without liability or, in its discretion, to deduct from the contract price or consideration, or otherwise recover, the full amount of the contingent fee.

(b) "Bona fide agency," as used in this clause, means an established commercial or selling agency, maintained by a contractor for the purpose of securing business, that neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds itself out as being able to obtain any Government contract or contracts through improper influence.

"Bona fide employee," as used in this clause, means a person, employed by a contractor and subject to the contractor's supervision and control as to time, place, and manner of performance, who neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds out as being able to obtain any Government contract or contracts through improper influence.

"Contingent fee," as used in this clause, means any commission, percentage, brokerage, or other fee that is contingent upon the success that a person or concern has in securing a Government contract.

"Improper influence," as used in this clause, means any influence that induces or tends to induce a Government employee or officer to give consideration or to act regarding a Government contract on any basis other than the merits of the matter.

**6. \*FAR 52.203-7 ANTI-KICKBACK PROCEDURES (JUL 1995)**

(a) Definitions.

"Kickback," as used in this clause, means any money, fee, commission, credit, gift, gratuity, thing of value, or compensation of any kind which is provided, directly or indirectly, to any prime Contractor, prime Contractor employee, subcontractor, or subcontractor employee for the purpose of improperly obtaining or rewarding favorable treatment in connection with a prime contract or in connection with a subcontract relating to a prime contract. "Person," as used in this clause, means a corporation, partnership, business association of any kind, trust, joint-stock company, or individual.

"Prime contract," as used in this clause, means a contract or contractual action entered into by the United States for the purpose of obtaining supplies, materials, equipment, or services of any kind.

"Prime Contractor," as used in this clause, means a person who has entered into a prime contract with the United States.

"Prime Contractor employee," as used in this clause, means any officer, partner, employee, or agent of a prime Contractor.

"Subcontract," as used in this clause, means a contract or contractual action entered into by a prime Contractor or subcontractor for the purpose of obtaining supplies, materials, equipment, or services of any kind under a prime contract.

"Subcontractor," as used in this clause, (1) means any person, other than the prime Contractor, who offers to furnish or furnishes any supplies, materials, equipment, or services of any kind under a prime contract or a

subcontract entered into in connection with such prime contract, and (2) includes any person who offers to furnish or furnishes general supplies to the prime Contractor or a higher tier subcontractor.

"Subcontractor employee," as used in this clause, means any officer, partner, employee, or agent of a subcontractor.

(b) The Anti-Kickback Act of 1986 (41 U.S.C. 51-58) (the Act), prohibits any person from--  
(1) Providing or attempting to provide or offering to provide any kickback;  
(2) Soliciting, accepting, or attempting to accept any kickback; or  
(3) Including, directly or indirectly, the amount of any kickback in the contract price charged by a prime Contractor to the United States or in the contract price charged by a subcontractor to a prime Contractor or higher tier subcontractor.

(c) (1) The Contractor shall have in place and follow reasonable procedures designed to prevent and detect possible violations described in paragraph (b) of this clause in its own operations and direct business relationships.

(2) When the Contractor has reasonable grounds to believe that a violation described in paragraph (b) of this clause may have occurred, the Contractor shall promptly report in writing the possible violation. Such reports shall be made to the inspector general of the contracting agency, the head of the contracting agency if the agency does not have an inspector general, or the Department of Justice.

(3) The Contractor shall cooperate fully with any Federal agency investigating a possible violation described in paragraph (b) of this clause.

(4) The Contracting Officer may  
(i) offset the amount of the kickback against any monies owed by the United States under the prime contract and/or  
(ii) direct that the Prime Contractor withhold from sums owed a subcontractor under the prime contract the amount of the kickback. The Contracting Officer may order that monies withheld under subdivision (c)(4)(ii) of this clause be paid over to the Government unless the Government has already offset those monies under subdivision (c)(4)(i) of this clause. In either case, the Prime Contractor shall notify the Contracting Officer when the monies are withheld.

(5) The Contractor agrees to incorporate the substance of this clause, including subparagraph (c)(5) but excepting subparagraph (c)(1), in all subcontracts under this contract which exceed \$100,000.

## **7. \*FAR 52.203-8 CANCELLATION, RESCISSION, AND RECOVERY OF FUNDS FOR ILLEGAL OR IMPROPER ACTIVITY (JAN 1997)**

(a) If the Government receives information that a contractor or a person has engaged in conduct constituting a violation of subsection (a), (b), (c), or (d) of Section 27 of the Office of Federal Procurement Policy Act (41 U.S.C. 423) (the Act), as amended by section 4304 of the National Defense Authorization Act for Fiscal Year 1996 (Pub. L. 104-106), the Government may--

(1) Cancel the solicitation, if the contract has not yet been awarded or issued; or  
(2) Rescind the contract with respect to which--  
(i) The Contractor or someone acting for the Contractor has been convicted for an offense where the conduct constitutes a violation of subsection 27 (a) or (b) of the Act for the purpose of either--  
(A) Exchanging the information covered by such subsections for anything of value; or  
(B) Obtaining or giving anyone a competitive advantage in the award of a Federal agency procurement contract; or  
(ii) The head of the contracting activity has determined, based upon a preponderance of the evidence, that the Contractor or someone acting for the Contractor has engaged in conduct constituting an offense punishable under subsection 27(e)(1) of the Act.

(b) If the Government rescinds the contract under paragraph (a) of this clause, the Government is entitled to recover, in addition to any penalty prescribed by law, the amount expended under the contract.

(c) The rights and remedies of the Government specified herein are not exclusive, and are in addition to any other rights and remedies provided by law, regulation, or under this contract.

**8. DFARS 252.203-7001 PROHIBITION ON PERSONS CONVICTED OF FRAUD OR OTHER DEFENSE—CONTRACT-RELATED FELONIES (MARCH 1999)**

- (a) Definitions.  
As used in this clause--
- (1) "Arising out of a contract with the "DoD" means any any act in connection with--
    - (i) Attempting to obtain;
    - (ii) Obtaining; or
    - (iii) Performing a contract or first-tier subcontract of any department, or component of the Department of Defense (DoD).
  - (2) "Conviction of fraud or any other felony," means any conviction for fraud or a felony in violation of state or Federal criminal statutes, whether entered on a verdict or plea, including a plea of nolo contendere, for which sentence has been imposed.
  - (3) "Date of conviction," means the date judgement was entered against the individual.
- (b) Any individual who is convicted after September 29, 1988 of fraud or any other felony arising out of a contract with the DoD is prohibited from serving--
- (1) In a management or supervisory capacity on any DoD contract or first-tier subcontract;
  - (2) On board of directors of any DoD Contractor or first-tier subcontractor;
  - (3) As a consultant to any DoD Contractor or first-tier subcontractor; or
  - (4) In any other capacity with the authority to influence, advise, or control the decisions of any DoD contractor or subcontractor with regard to any DoD contract or first-tier subcontract.
- (c) Unless waived, the prohibition in paragraph (b) of this clause applies for not less than five years from the date of conviction.
- (d) 10 U.S.C. 2408 provides that a defense Contractor or first-tier subcontractor shall be subject to a criminal penalty of not more than \$500,000 if convicted of knowingly--
- (1) Employing a person under a prohibition in paragraph (b) of this clause;
  - (2) Allowing such a person to serve on the board of directors of Contractor or first-tier subcontractor.
- (e) In addition to the criminal penalties contained in 10 U.S.C. 2408, the Government may consider other available remedies, such as--
- (1) Suspension or debarment;
  - (2) Cancellation of the contract at no cost to the Government; or
  - (3) Termination of the contract for default.
- (f) The Contractor may submit written requests for waiver of the prohibition in paragraph (b) of this clause to the Contracting Officer. Requests shall clearly identify--
- (1) The person involved;
  - (2) The nature of the conviction and resultant sentence or punishment imposed;
  - (3) The reasons for the requested waiver; and
  - (4) An explanation of why a waiver is in the interest of national security.
- (g) The Contractor agrees to include the substance of this clause appropriately modified to reflect the identity and relationship of the parties, in all first-tier subcontracts exceeding the simplified acquisition threshold in Part 2 of the Federal Acquisition Regulation, except those for commercial items or components.
- (h) Pursuant to 10 U.S.C.2408(c), defense contractors and subcontractors may obtain information as to whether a particular has been convicted of fraud or any other felony arising out of a contract with the DoD by contracting The Office of Justice Programs, The Denial of Federal Benefits Office, U.S. Department of Justice, telephone (202) 616-3507.

**9. DFARS 252.203-7002 DISPLAY OF DOD HOTLINE POSTER (DEC 1991) (For Military Contracts Exceeding \$5,000,000)**

- (a) The Contractor shall display prominently in common work areas within business segments performing work under Department of Defense (DoD) contracts, DoD Hotline Posters prepared by DoD Office of the Inspector General.

(b) DoD Hotline Posters may be obtained from the DoD Inspector General, ATTN: Defense Hotline, 400 Army Navy Drive, Washington DC 22202-2884.

(c) The Contract need not comply with paragraph (a) of this clause if it has established a mechanism, such as a hotline, by which employees may report suspected instances of improper conduct, and instructions that encourage employees to make such reports.

**10. \*FAR 52.203-10 PRICE OR FEE ADJUSTMENT FOR ILLEGAL OR IMPROPER ACTIVITY (JAN 1997)**

(a) The Government, at its election, may reduce the price of a fixed-price type contract and the total cost and fee under a cost-type contract of profit or fee determined as set forth in paragraph (b) of this clause if the head of the contracting activity or designee determines that there was a violation of subsection 27(a), (b), or (c) of the Office of Federal Procurement Policy Act, as amended (41 U.S.C. 423), as implemented in section 3.104 of the Federal Acquisition Regulation.

(b) The price or fee reduction referred to in paragraph (a) of this clause shall be--

(1) For cost-plus-fixed-fee contracts, the amount of the fee specified in the contract at the time of award;

(2) For cost-plus-incentive-fee contracts, the target fee specified in the contract at the time of award, notwithstanding any minimum fee or "fee floor" specified in the contract;

(3) For cost-plus-award-fee contracts--

(i) The base fee established in the contract at the time of contract award;

(ii) If no base fee is specified in the contract, 30 percent of the amount of each award fee otherwise payable to the Contractor for each award fee evaluation period or at each award fee determination point.

(4) For fixed-price-incentive contracts, the Government may--

(i) Reduce the contract target price and contract target profit both by an amount equal to the initial target profit specified in the contract at the time of contract award; or

(ii) If an immediate adjustment to the contract target price and contract target profit would have a significant adverse impact on the incentive price revision relationship under the contract, or adversely affect the contract financing provisions, the Contracting Officer may defer such adjustment until establishment of the total final price of the contract. The total final price established in accordance with the incentive price revision provisions of the contract shall be reduced by an amount equal to the initial target profit specified in the contract at the time of contract award and such reduced price shall be the total final contract price.

(5) For firm-fixed-price contracts, by 10 percent of the initial contract price or a profit amount determined by the Contracting Officer from records or documents in existence prior to the date of the contract award.

(c) The Government may, at its election, reduce a prime contractor's price or fee in accordance with the procedures of paragraph (b) of this clause for violations of the Act by its subcontractors by an amount not to exceed the amount of profit or fee reflected in the subcontract at the time the subcontract was first definitively priced.

(d) In addition to the remedies in paragraphs (a) and (c) of this clause, the Government may terminate this contract for default. The rights and remedies of the Government specified herein are not exclusive, and are in addition to any other rights and remedies provided by law or under this contract.

**11. \*FAR 52.203-12 LIMITATION ON PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS (JUN 1997)**

(a) Definitions.

"Agency," as used in this clause, means executive agency as defined in 2.101.

"Covered Federal Action," as used in this clause, means any of the following Federal actions:

(1) The awarding of any Federal contract.

(2) The making of any Federal grant.

(3) The making of any Federal loan.

(4) The entering into of any cooperative agreement.

(5) The extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

"Indian tribe" and "tribal organization," as used in this clause, have the meaning provided in section 4 of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 450B) and include Alaskan Natives.

"Influencing or attempting to influence," as used in this clause, means making, with the intent to influence, any communication to or appearance before an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with any covered Federal action.

"Local government," as used in this clause, means a unit of government in a State and, if chartered, established, or otherwise recognized by a State for the performance of a governmental duty, including a local public authority, a special district, an intrastate district, a council of governments, a sponsor group representative organization, and any other instrumentality of a local government.

"Officer or employee of an agency," as used in this clause, includes the following individuals who are employed by an agency:

(1) An individual who is appointed to a position in the Government under title 5, United States Code, including a position under a temporary appointment.

(2) A member of the uniformed services, as defined in subsection 101(3), title 37, United States Code.

(3) A special Government employee, as defined in section 202, title 18, United States Code.

(4) An individual who is a member of a Federal advisory committee, as defined by the Federal Advisory Committee Act, title 5, United States Code, appendix 2.

"Person," as used in this clause, means an individual, corporation, company, association, authority, firm, partnership, society, State and local government, regardless of whether such entity is operated for profit, or not for profit. This term excludes an Indian tribe, tribal organization, or any other Indian organization with respect to expenditures specifically permitted by other Federal law.

"Reasonable compensation," as used in this clause, means, with respect to a regularly employed officer or employee of any person, compensation that is consistent with the normal compensation for such officer or employee for work that is not furnished to, not funded by, or not furnished in cooperation with the Federal Government.

"Reasonable payment," as used in this clause, means, with respect to professional and other technical services, a payment in an amount that is consistent with the amount normally paid for such services in the private sector.

"Recipient," as used in this clause, includes the Contractor and all subcontractors. This term excludes an Indian tribe, tribal organization, or any other Indian organization with respect to expenditures specifically permitted by other Federal law.

"Regularly employed," as used in this clause, means, with respect to an officer or employee of a person requesting or receiving a Federal contract, an officer or employee who is employed by such person for at least 130 working days within 1 year immediately preceding the date of the submission that initiates agency consideration of such person for receipt of such contract. An officer or employee who is employed by such person for less than 130 working days within 1 year immediately preceding the date of the submission that initiates agency consideration of such person shall be considered to be regularly employed as soon as he or she is employed by such person for 130 working days.

"State," as used in this clause, means a State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, a territory or possession of the United States, an agency or instrumentality of a State, and multi-State, regional, or interstate entity having governmental duties and powers.

(b) Prohibitions.

(1) Section 1352 of title 31, United States Code, among other things, prohibits a recipient of a Federal Contract, grant, loan, or cooperative agreement from using appropriated funds to pay any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with any of the following covered Federal actions: The awarding of any Federal contract; the making of any Federal grant; the making of any Federal loan; the entering into of any cooperative agreement; or the modification of any Federal contract, grant, loan, or cooperative agreement.

(2) The Act also requires Contractors to furnish a disclosure if any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with a Federal contract, grant, loan, or cooperative agreement.

(3) The prohibitions of the Act do not apply under the following conditions:

(i) Agency and legislative liaison by own employees.

(A) The prohibition on the use of appropriated funds, in subparagraph (b)(1) of this clause, does not apply in the case of a payment of reasonable compensation made to an officer or employee of a person requesting or receiving a covered Federal action if the payment is for agency and legislative liaison activities not directly related to a covered Federal action.

(B) For purposes of subdivision (b)(3)(i)(A) of this clause, providing any information specifically requested by an agency or Congress is permitted at any time.

(C) The following agency and legislative liaison activities are permitted at any time where they are not related to a specific solicitation for any covered Federal action:

(1) Discussing with an agency the qualities and characteristics (including individual demonstrations) of the person's products or services, conditions or terms of sale, and service capabilities.

(2) Technical discussions and other activities regarding the application or adaptation of the person's products or services for an agency's use.

(D) The following agency and legislative liaison activities are permitted where they are prior to formal solicitation of any covered Federal action--

(1) Providing any information not specifically requested but necessary for an agency to make an informed decision about initiation of a covered Federal action;

(2) Technical discussions regarding the preparation of an unsolicited proposal prior to its official submission; and

(3) Capability presentations by persons seeking awards from an agency pursuant to the provisions of the Small Business Act, as amended by Pub. L. 95-507, and subsequent amendments.

(E) Only those services expressly authorized by subdivision (b)(3)(i)(A) of this clause are permitted under this clause.

(ii) Professional and technical services.

(A) The prohibition on the use of appropriated funds, in subparagraph (b)(1) of this clause, does not apply in the case of--

(1) A payment of reasonable compensation made to an officer or employee of a person requesting or receiving a covered Federal action or an extension, continuation, renewal, amendment, or modification of a covered Federal action, if payment is for professional or technical services rendered directly in the preparation, submission, or negotiation of any bid, proposal, or application for that Federal action or for meeting requirements imposed by or pursuant to law as a condition for receiving that Federal action.

(2) Any reasonable payment to a person, other than an officer or employee of a person requesting or receiving a covered Federal action or an extension, continuation, renewal, amendment, or modification of a covered Federal action if the payment is for professional or technical services rendered directly in the preparation, submission, or negotiation of any bid, proposal, or application for that Federal action or for meeting requirements imposed by or pursuant to law as a condition for receiving that Federal action. Persons other than officers or employees of a person requesting or receiving a covered Federal action include consultants and trade associations.

(B) For purposes of subdivision (b)(3)(ii)(A) of this clause, "professional and technical services" shall be limited to advice and analysis directly applying any professional or technical discipline. For example, drafting of a legal document accompanying a bid or proposal by a lawyer is allowable. Similarly, technical advice provided by an engineer on the performance or operational capability of a piece of equipment rendered directly in the negotiation of a contract is allowable. However, communications with the intent to influence made by a professional (such as a licensed lawyer) or a technical person (such as a licensed accountant) are not allowable under this section unless they provide advice and analysis directly applying their professional or technical expertise and unless the advice or analysis is rendered directly and solely in the preparation, submission or

negotiation of a covered Federal action. Thus, for example, communications with the intent to influence made by a lawyer that do not provide legal advice or analysis directly and solely related to the legal aspects of his or her client's proposal, but generally advocate one proposal over another are not allowable under this section because the lawyer is not providing professional legal services. Similarly, communications with the intent to influence made by an engineer providing an engineering analysis prior to the preparation or submission of a bid or proposal are not allowable under this section since the engineer is providing technical services but not directly in the preparation, submission or negotiation of a covered Federal action.

(C) Requirements imposed by or pursuant to law as a condition for receiving a covered Federal award include those required by law or regulation and any other requirements in the actual award documents.

(D) Only those services expressly authorized by subdivisions (b)(3)(ii)(A)(1) and (2) of this clause are permitted under this clause.

(E) The reporting requirements of FAR 3.803(a) shall not apply with respect to payments of reasonable compensation made to regularly employed officers or employees of a person.

(iii) Disclosure.

(A) The Contractor who requests or receives from an agency a Federal contract shall file with that agency a disclosure form, OMB standard form LLL, Disclosure of Lobbying Activities, if such person has made or has agreed to make any payment using nonappropriated funds (to include profits from any covered Federal action), which would be prohibited under subparagraph (b)(1) of this clause, if paid for with appropriated funds.

(B) The Contractor shall file a disclosure form at the end of each calendar quarter in which there occurs any event that materially affects the accuracy of the information contained in any disclosure form previously filed by such person under subparagraph (c)(1) of this clause. An event that materially affects the accuracy of the information reported includes--

(1) A cumulative increase of \$25,000 or more in the amount paid or expected to be paid for influencing or attempting to influence a covered Federal action; or

(2) A change in the person(s) or individual(s) influencing or attempting to influence a covered Federal action; or

(3) A change in the officer(s), employee(s), or Member(s) contacted to influence or attempt to influence a covered Federal action.

(C) The Contractor shall require the submittal of a certification, and if required, a disclosure form by any person who requests or receives any subcontract exceeding \$100,000 under the Federal contract.

(D) All subcontractor disclosure forms (but not certifications) shall be forwarded from tier to tier until received by the prime Contractor. The prime Contractor shall submit all disclosures to the Contracting Officer at the end of the calendar quarter in which the disclosure form is submitted by the subcontractor. Each subcontractor certification shall be retained in the subcontract file of the awarding Contractor.

(iv) Agreement. The Contractor agrees not to make any payment prohibited by this clause.

(v) Penalties.

(A) Any person who makes an expenditure prohibited under paragraph (a) of this clause or who fails to file or amend the disclosure form to be filed or amended by paragraph (b) of this clause shall be subject to civil penalties as provided for by 31 U.S.C. 1352. An imposition of a civil penalty does not prevent the Government from seeking any other remedy that may be applicable.

(B) Contractors may rely without liability on the representation made by their subcontractors in the certification and disclosure form.

(vi) Cost allowability. Nothing in this clause makes allowable or reasonable any costs which would otherwise be unallowable or unreasonable. Conversely, costs made specifically unallowable by the requirements in this clause will not be made allowable under any other provision.

**12. \*FAR 52.204-4 PRINTED OR COPIED DOUBLE-SIDED ON RECYCLED PAPER (AUG 2000)**

(a) Definitions. As used in this clause—

“Postconsumer material” means a material or finished product that has served its intended use and has been discarded for disposal or recovery, having completed its life as a consumer item. Postconsumer material is a part of the broader category of “recovered material.” For paper and paper products, postconsumer material means “postconsumer fiber” defined by the U.S. Environmental Protection Agency (EPA) as—

(1) Paper, paperboard, and fibrous materials from retail stores, office buildings, homes, and so forth, after they have passed through their end-usage as a consumer item, including: used corrugated boxes; old newspapers; old magazines; mixed waste paper; tabulating cards; and used cordage; or

(2) All paper, paperboard, and fibrous materials that enter and are collected from municipal solid waste; but not

(3) Fiber derived from printers' over-runs, converters' scrap, and over-issue publications.

“Printed or copied double-sided” means printing or reproducing a document so that information is on both sides of a sheet of paper.

“Recovered material,” for paper and paper products, is defined by EPA in its Comprehensive Procurement Guideline as “recovered fiber” and means the following materials:

(1) Postconsumer fiber; and

(2) Manufacturing wastes such as—

(i) Dry paper and paperboard waste generated after completion of the papermaking process (that is, those manufacturing operations up to and including the cutting and trimming of the paper machine reel into smaller rolls or rough sheets) including: envelope cuttings, bindery trimmings, and other paper and paperboard waste resulting from printing, cutting, forming, and other converting operations; bag, box, and carton manufacturing wastes; and butt rolls, mill wrappers, and rejected unused stock; and

(ii) Repulped finished paper and paperboard from obsolete inventories of paper and paperboard manufacturers, merchants, wholesalers, dealers, printers, converters, or others.

(b) In accordance with Section 101 of Executive Order 13101 of September 14, 1998, Greening the Government through Waste Prevention, Recycling, and Federal Acquisition, the Contractor is encouraged to submit paper documents, such as offers, letters, or reports, that are printed or copied double-sided on recycled paper that meet minimum content standards specified in Section 505 of Executive Order 13101, when not using electronic commerce methods to submit information or data to the Government.

(c) If the Contractor cannot purchase high-speed copier paper, offset paper, forms bond, computer printout paper, carbonless paper, file folders, white wove envelopes, writing and office paper, book paper, cotton fiber paper, and cover stock meeting the 30 percent postconsumer material standard for use in submitting paper documents to the Government, it should use paper containing no less than 20 percent postconsumer material. This lesser standard should be used only when paper meeting the 30 percent postconsumer material standard is not obtainable at a reasonable price or does not meet reasonable performance standards.

(End of clause)

### **13. DFARS 252.204-7003 CONTROL OF GOVERNMENT PERSONNEL WORK PRODUCT (APR 1992)**

The Contractor's procedures for protecting against unauthorized disclosure of information shall not require Department of Defense employees or members of the Armed Forces to relinquish control of their work products, whether classified or not, to the Contractor.

### **14. \*FAR 52.209-6 PROTECTING THE GOVERNMENT'S INTEREST WHEN SUBCONTRACTING WITH CONTRACTORS DEBARRED, SUSPENDED, OR PROPOSED FOR DEBARMENT (JUL 1995)**

(a) The Government suspends or debar Contractors to protect the Government's interests. The Contractor shall not enter into any subcontract in excess of \$25,000 with a Contractor that is debarred, suspended, or proposed for debarment unless there is a compelling reason to do so.

(b) The Contractor shall require each proposed first-tier subcontractor, whose subcontract will exceed \$25,000, to disclose to the Contractor, in writing, whether as of the time of award of the subcontract, the subcontractor, or its principals, is or is not debarred, suspended, or proposed for debarment by the Federal Government.

(c) A corporate office or a designee of the Contractor shall notify the Contracting Officer, in writing, before entering into a subcontract with a party that is debarred, suspended, or proposed for debarment (see FAR 9.404 for information on the List of Parties Excluded from Procurement Programs). The notice must include the following:

- (1) The name of the subcontractor.
- (2) The Contractor's knowledge of the reasons for the subcontractor being on the List of Parties Excluded from Procurement Programs.
- (3) The compelling reason(s) for doing business with the subcontractor notwithstanding its inclusion on the List of Parties Excluded From Procurement Programs.
- (4) The systems and procedures the Contractor has established to ensure that it is fully protecting the Government's interests when dealing with such subcontractor in view of the specific basis for the party's debarment, suspension, or proposed debarment.

**15. DFARS 252.209-7004 SUBCONTRACTING WITH FIRMS THAT ARE OWNED OR CONTROLLED BY THE GOVERNMENT OF A TERRORIST COUNTRY (MAR 1998)**

(a) Unless the Government determines that there is a compelling reason to do so, the Contractor shall not enter into any subcontract in excess of \$25,000 with a firm, or a subsidiary of a firm, that is identified, on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs, as being ineligible for the award of Defense contracts or subcontracts because it is owned or controlled by the government of a terrorist country.

(b) A corporate officer or a designee of the Contractor shall notify the Contracting Officer, in writing, before entering into a subcontract with a party that is identified, on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs, as being ineligible for the award of Defense contracts or subcontracts because it is owned or controlled by the government of a terrorist country. The notice must include the name of the proposed subcontractor and the compelling reason(s) for doing business with the subcontractor notwithstanding its inclusion on the List of Parties Excluded From Federal Procurement and Nonprocurement Programs.

(End of clause)

**16. \*FAR 52.211-15 DEFENSE PRIORITY AND ALLOCATION REQUIREMENTS (SEP 1990) [For Military Contract's Only]**

This is a rated order certified for national defense use, and the Contractor shall follow all the requirements of the Defense Priorities and Allocations System regulation (15 CFR 700).

**17. FAR 52.211-18 VARIATION IN ESTIMATED QUANTITY (APR 1984)**

If the quantity of a unit-priced item in this contract is an estimated quantity and the actual quantity of the unit-priced item varies more than 15 percent above or below the estimated quantity, an equitable adjustment in the contract price shall be made upon demand of either party. The equitable adjustment shall be based upon any increase or decrease in costs due solely to the variation above 115 percent or below 85 percent of the estimated quantity. If the quantity variation is such as to cause an increase in the time necessary for completion, the Contractor may request, in writing, an extension of time, to be received by the Contracting Officer within 10 days from the beginning of the delay, or within such further period as may be granted by the Contracting Officer before the date of final settlement of the contract. Upon the receipt of a written request for an extension, the Contracting

Officer shall ascertain the facts and make an adjustment for extending the completion date as, in the judgement of the Contracting Officer, is justified.

**18. \*FAR 52.214-26      AUDIT AND RECORDS--SEALED BIDDING (OCT 1997)**

(a) As used in this clause, "records" includes books, documents, accounting procedures and practices, and other data, regardless of whether such items are in written form, in the form of computer data, or in any other form.

(b) Cost or pricing data. If the Contractor has submitted cost or pricing data in connection with the pricing of any modification to this contract, the Contracting Officer or authorized representative of the Contracting Officer, in order to evaluate the accuracy, completeness, and currency of the cost or pricing data, shall have the right to examine and audit all of the Contractor's records, including computations and projections related to--

- (1) The proposal for the modification;
- (2) The discussions conducted on the proposal(s), including those related to negotiating;
- (3) Pricing of the modification; or
- (4) Performance of the modification.

(c) Comptroller General. In the case of pricing any modification, the Comptroller General of the United States, or an authorized representative, shall have the same rights as specified in paragraph (b) of this clause.

(d) Availability. The Contractor shall make available at its office at all reasonable times the materials described in paragraph (b) of this clause, for examination, audit, or reproduction, until 3 years after final payment under this contract, or for any other period specified in Subpart 4.7 of the Federal Acquisition Regulation (FAR). FAR Subpart 4.7, Contractor Records Retention, in effect on the date of this contract, is incorporated by reference in its entirety and made a part of this contract.

(1) If this contract is completely or partially terminated, the records relating to the work terminated shall be made available for 3 years after any resulting final termination settlement.

(2) Records pertaining to appeals under the Disputes clause or to litigation or the settlement of claims arising under or relating to the performance of this contract shall be made available until disposition of such appeals, litigation, or claims.

(e) The Contractor shall insert a clause containing all the provisions of this clause, including this paragraph (e), in all subcontracts expected to exceed the threshold in FAR 15.403-4(a)(1) for submission of cost or pricing data.

**19. \*FAR 52.214-27      PRICE REDUCTION FOR DEFECTIVE COST OR PRICING DATA—  
MODIFICATIONS--SEALED BIDDING (OCT 1997)**

(a) This clause shall become operative only for any modification to this contract involving aggregate increases and/or decreases in costs, plus applicable profits, expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1), except that this clause does not apply to any modification if an exception under FAR 15.403-1(b) applies.

(b) If any price, including profit, negotiated in connection with any modification under this clause, was increased by any significant amount because

(1) The Contractor or a subcontractor furnished cost or pricing data that were not complete, accurate, and current as certified in its Certificate of Current Cost or Pricing Data,

(2) a subcontractor or prospective subcontractor furnished the Contractor cost or pricing data that were not complete, accurate, and current as certified in the Contractor's Certificate of Current Cost or Pricing Data, or

(3) Any of these parties furnished data of any description that were not accurate, the price shall be reduced accordingly and the contract shall be modified to reflect the reduction. This right to a price reduction is limited to that resulting from defects in data relating to modifications for which this clause becomes operative under paragraph (a) of this clause.

- (c) Any reduction in the contract price under paragraph (b) above due to defective data from a prospective subcontractor that was not subsequently awarded the subcontract shall be limited to the amount, plus applicable overhead and profit markup, by which
- (1) the actual subcontract or
  - (2) the actual cost to the Contractor, if there was no subcontract, was less than the prospective subcontract cost estimate submitted by the Contractor; provided, that the actual subcontract price was not itself affected by defective cost or pricing data.
- (d) (1) If the Contracting Officer determines under paragraph (b) of this clause that a price or cost reduction should be made, the Contractor agrees not to raise the following matters as a defense:
- (i) The Contractor or subcontractor was a sole source supplier or otherwise was in a superior bargaining position and thus the price of the contract would not have been modified even if accurate, complete, and current cost or pricing data had been submitted.
  - (ii) The Contracting Officer should have known that the cost or pricing data in issue were defective even though the Contractor or subcontractor took no affirmative action to bring the character of the data to the attention of the Contracting Officer.
  - (iii) The contract was based on an agreement about the total cost of the contract and there was no agreement about the cost of each item procured under the contract.
  - (iv) The Contractor or subcontractor did not submit a Certificate of Current Cost or Pricing Data.
- (2) (i) Except as prohibited by subdivision (d)(2)(ii) of this clause, an offset in an amount determined appropriate by the Contracting Officer based upon the facts shall be allowed against the amount of a contract price reduction if--
- (A) The Contractor certifies to the Contracting Officer that, to the best of the Contractor's knowledge and belief, the Contractor is entitled to the offset in the amount requested; and
  - (B) The Contractor proves that the cost or pricing data were available before the date of agreement on the price of the contract (or price of the modification) and that the data were not submitted before such date.
- (ii) An offset shall not be allowed if--
- (A) The understated data was known by the Contractor to be understated when the Certificate of Current Cost or Pricing Data was signed; or
  - (B) The Government proves that the facts demonstrate that the contract price would not have increased in the amount to be offset even if the available data had been submitted before the date of agreement on price.
- (e) If any reduction in the contract price under this clause reduces the price of items for which payment was made prior to the date of the modification reflecting the price reduction, the Contractor shall be liable to and shall pay the United States at the time such overpayment is repaid--
- (1) Simple interest on the amount of such overpayment to be computed from the date(s) of overpayment to the Contractor to the date the Government is repaid by the Contractor at the applicable underpayment rate effective for each quarter prescribed by the Secretary of the Treasury under 26 U.S.C. 6621(a)(2); and
  - (2) A penalty equal to the amount of the overpayment, if the Contractor or subcontractor knowingly submitted cost or pricing data which were incomplete, inaccurate, or noncurrent.

**20. \*FAR 52.214-28 SUBCONTRACTOR COST OR PRICING DATA--MODIFICATIONS—SEALED BIDDING (OCT 1997)**

- (a) The requirements of paragraphs (b) and (c) of this clause shall--
- (1) Become operative only for any modification to this contract involving aggregate increases and/or decreases in costs, plus applicable profits, expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1); and

(2) Be limited to such modifications.

(b) Before awarding any subcontract expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1), on the date of agreement on price or the date of award, whichever is later; or before pricing any subcontract modification involving aggregate increases and/or decreases in costs, plus applicable profits, expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1), the Contractor shall require the subcontractor to submit cost or pricing data (actually or by specific identification in writing), unless an exception under FAR 15.403-1(b) applies.

(c) The Contractor shall require the subcontractor to certify in substantially the form prescribed in FAR subsection 15.406-2 that, to the best of its knowledge and belief, the data submitted under paragraph (b) above were accurate, complete, and current as of the date of agreement on the negotiated price of the subcontract or subcontract modification.

(d) The Contractor shall insert the substance of this clause, including this paragraph (d), in each subcontract that when entered into, exceeds the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1).

(End of clause)

**21. \*FAR 52.219-4 NOTICE OF PRICE EVALUATION PREFERENCE FOR HUBZONE SMALL BUSINESS CONCERNS (JAN 1999)**

(a) *Definition.* "HUBZone small business concern," as used in this clause, means a small business concern that appears on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration.

(b) *Evaluation preference.* (1) Offers will be evaluated by adding a factor of 10 percent to the price of all offers, except—

(i) Offers from HUBZone small business concerns that have not waived the evaluation preference;

(ii) Otherwise successful offers from small business concerns;

(iii) Otherwise successful offers of eligible products under the Trade Agreements Act when the dollar threshold for application of the Act is exceeded (see 25.402 of the Federal Acquisition Regulation (FAR)); and

(iv) Otherwise successful offers where application of the factor would be inconsistent with a Memorandum of Understanding or other international agreement with a foreign government.

(2) The factor of 10 percent shall be applied on a line item basis or to any group of items on which award may be made. Other evaluation factors described in the solicitation shall be applied before application of the factor.

(3) A concern that is both a HUBZone small business concern and a small disadvantaged business concern will receive the benefit of both the HUBZone small business price evaluation preference and the small disadvantaged business price evaluation adjustment (see FAR clause 52.219-23). Each applicable price evaluation preference or adjustment shall be calculated independently against an offeror's base offer. These individual preference amounts shall be added together to arrive at the total evaluated price for that offer.

(c) *Waiver of evaluation preference.* A HUBZone small business concern may elect to waive the evaluation preference, in which case the factor will be added to its offer for evaluation purposes. The agreements in paragraph (d) of this clause do not apply if the offeror has waived the evaluation preference.

[ ] Offeror elects to waive the evaluation preference.

(d) *Agreement.* A HUBZone small business concern agrees that in the performance of the contract, in the case of a contract for—

(1) Services (except construction), at least 50 percent of the cost of personnel for contract performance will be spent for employees of the concern or employees of other HUBZone small business concerns;

(2) Supplies (other than procurement from a nonmanufacturer of such supplies), at least 50 percent of the cost of manufacturing, excluding the cost of materials, will be performed by the concern or other HUBZone

small business concerns;

(3) General construction, at least 15 percent of the cost of the contract performance incurred for personnel will be spent on the concern's employees or the employees of other HUBZone small business concerns; or

(4) Construction by special trade contractors, at least 25 percent of the cost of the contract performance incurred for personnel will be spent on the concern's employees or the employees of other HUBZone small business concerns.

(e) A HUBZone joint venture agrees that in the performance of the contract, the applicable percentage specified in paragraph (d) of this clause will be performed by the HUBZone small business participant or participants.

(f) A HUBZone small business concern nonmanufacturer agrees to furnish in performing this contract only end items manufactured or produced by HUBZone small business manufacturer concerns. This paragraph does not apply in connection with construction or service contracts.

(End of clause)

## **22. \*FAR 52.219-8 UTILIZATION OF SMALL BUSINESS CONCERNS (OCT 2000)**

(a) It is the policy of the United States that small business concerns, veteran-owned small business concerns, service-disabled veteran-owned small business concerns, HUBZone small business concerns, small disadvantaged business concerns, and women-owned small business concerns shall have the maximum practicable opportunity to participate in performing contracts let by any Federal agency, including contracts and subcontracts for subsystems, assemblies, components, and related services for major systems. It is further the policy of the United States that its prime contractors establish procedures to ensure the timely payment of amounts due pursuant to the terms of their subcontracts with small business concerns, veteran-owned small business concerns, service-disabled veteran-owned small business concerns, HUBZone small business concerns, small disadvantaged business concerns, and women-owned small business concerns.

(b) The Contractor hereby agrees to carry out this policy in the awarding of subcontracts to the fullest extent consistent with efficient contract performance. The Contractor further agrees to cooperate in any studies or surveys as may be conducted by the United States Small Business Administration or the awarding agency of the United States as may be necessary to determine the extent of the Contractor's compliance with this clause.

(c) *Definitions.* As used in this contract—

“HUBZone small business concern” means a small business concern that appears on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration .

“Service-disabled veteran-owned small business concern ” —

(1) Means a small business concern—

(i) Not less than 51 percent of which is owned by one or more service-disabled veterans or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more service-disabled veterans; and

(ii) The management and daily business operations of which are controlled by one or more service-disabled veterans or, in the case of a veteran with permanent and severe disability, the spouse or permanent caregiver of such veteran.

(2) Service-disabled veteran means a veteran, as defined in 38 U.S.C. 101(2), with a disability that is service-connected, as defined in 38 U.S.C. 101(16).

“Small business concern” means a small business as defined pursuant to Section 3 of the Small Business Act and relevant regulations promulgated pursuant thereto.

“Small disadvantaged business concern” means a small business concern that represents, as part of its offer that—

(1) It has received certification as a small disadvantaged business concern consistent with 13 CFR part 124, Subpart B;

(2) No material change in disadvantaged ownership and control has occurred since its certification;

(3) Where the concern is owned by one or more individuals, the net worth of each individual upon whom the certification is based does not exceed \$750,000 after taking into account the applicable exclusions set forth at 13 CFR 124.104(c)(2); and

(4) It is identified, on the date of its representation, as a certified small disadvantaged business in the database maintained by the Small Business Administration (PRO-Net).

“Veteran-owned small business concern” means a small business concern—

(1) Not less than 51 percent of which is owned by one or more veterans (as defined at 38 U.S.C. 101(2)) or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more veterans; and

(2) The management and daily business operations of which are controlled by one or more veterans.

“Women-owned small business concern” means a small business concern—

(1) That is at least 51 percent owned by one or more women, or, in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and

(2) Whose management and daily business operations are controlled by one or more women.

(d) Contractors acting in good faith may rely on written representations by their subcontractors regarding their status as a small business concern, a veteran-owned small business concern, a service-disabled veteran-owned small business concern, a HUBZone small business concern, a small disadvantaged business concern, or a women-owned small business concern.

(End of clause)

**23. \*FAR 52.219-9 SMALL BUSINESS SUBCONTRACTING PLAN (JAN 2002) [When Contracting By Negotiations]**

(a) This clause does not apply to small business concerns.

(b) *Definitions.* As used in this clause—

“Commercial item” means a product or service that satisfies the definition of commercial item in section 2.101 of the Federal Acquisition Regulation.

“Commercial plan” means a subcontracting plan (including goals) that covers the offeror’s fiscal year and that applies to the entire production of commercial items sold by either the entire company or a portion thereof (*e.g.*, division, plant, or product line).

“Individual contract plan” means a subcontracting plan that covers the entire contract period (including option periods), applies to a specific contract, and has goals that are based on the offeror’s planned subcontracting in support of the specific contract, except that indirect costs incurred for common or joint purposes may be allocated on a prorated basis to the contract.

“Master plan” means a subcontracting plan that contains all the required elements of an individual contract plan, except goals, and may be incorporated into individual contract plans, provided the master plan has been approved.

“Subcontract” means any agreement (other than one involving an employer-employee relationship) entered into by a Federal Government prime Contractor or subcontractor calling for supplies or services required for performance of the contract or subcontract.

(c) The offeror, upon request by the Contracting Officer, shall submit and negotiate a subcontracting plan, where applicable, that separately addresses subcontracting with small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business concerns, small disadvantaged business, and women-owned small business concerns. If the offeror is submitting an individual contract plan, the plan must separately address subcontracting with small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns, with a separate part for the basic contract and separate parts for each option (if any). The plan shall be included in and made a part of the resultant contract. The subcontracting plan shall be negotiated within the time specified by the Contracting Officer. Failure to submit and negotiate the subcontracting plan shall make the offeror ineligible for award of a contract.

(d) The offeror's subcontracting plan shall include the following:

(1) Goals, expressed in terms of percentages of total planned subcontracting dollars, for the use of small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns as subcontractors. The offeror shall include all subcontracts that contribute to contract performance, and may

include a proportionate share of products and services that are normally allocated as indirect costs.

(2) A statement of—

(i) Total dollars planned to be subcontracted for an individual contract plan; or the offeror's total projected sales, expressed in dollars, and the total value of projected subcontracts to support the sales for a commercial plan;

(ii) Total dollars planned to be subcontracted to small business concerns;

(iii) Total dollars planned to be subcontracted to veteran-owned small business concerns;

(iv) Total dollars planned to be subcontracted to service-disabled veteran-owned small business;

(v) Total dollars planned to be subcontracted to HUBZone small business concerns;

(vi) Total dollars planned to be subcontracted to small disadvantaged business concerns;

and

(vii) Total dollars planned to be subcontracted to women-owned small business concerns.

(3) A description of the principal types of supplies and services to be subcontracted, and an identification of the types planned for subcontracting to—

(i) Small business concerns;

(ii) Veteran-owned small business concerns;

(iii) Service-disabled veteran-owned small business concerns;

(iv) HUBZone small business concerns;

(v) Small disadvantaged business concerns; and

(vi) Women-owned small business concerns.

(4) A description of the method used to develop the subcontracting goals in paragraph (d)(1) of this clause.

(5) A description of the method used to identify potential sources for solicitation purposes (*e.g.*, existing company source lists, the Procurement Marketing and Access Network (PRO-Net) of the Small Business Administration (SBA), veterans service organizations, the National Minority Purchasing Council Vendor Information Service, the Research and Information Division of the Minority Business Development Agency in the Department of Commerce, or small, HUBZone, small disadvantaged, and women-owned small business trade associations). A firm may rely on the information contained in PRO-Net as an accurate representation of a concern's size and ownership characteristics for the purposes of maintaining a small, veteran-owned small, service-disabled veteran-owned small, HUBZone small, small disadvantaged, and women-owned small business source list. Use of PRONet as its source list does not relieve a firm of its responsibilities (*e.g.*, outreach, assistance, counseling, or publicizing subcontracting opportunities) in this clause.

(6) A statement as to whether or not the offeror included indirect costs in establishing subcontracting goals, and a description of the method used to determine the proportionate share of indirect costs to be incurred with—

(i) Small business concerns;

(ii) Veteran-owned small business concerns;

(iii) Service-disabled veteran-owned small business concerns;

(iv) HUBZone small business concerns;

(v) Small disadvantaged business concerns; and

(vi) Women-owned small business concerns.

(7) The name of the individual employed by the offeror who will administer the offeror's subcontracting program, and a description of the duties of the individual.

(8) A description of the efforts the offeror will make to assure that small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns have an equitable opportunity to compete for subcontracts.

(9) Assurances that the offeror will include the clause of this contract entitled "Utilization of Small Business Concerns" in all subcontracts that offer further subcontracting opportunities, and that the offeror will require all subcontractors (except small business concerns) that receive subcontracts in excess of \$500,000 (\$1,000,000 for construction of any public facility) to adopt a subcontracting plan that complies with the requirements of this clause.

(10) Assurances that the offeror will—

(i) Cooperate in any studies or surveys as may be required;

(ii) Submit periodic reports so that the Government can determine the extent of compliance by the offeror with the subcontracting plan;

(iii) Submit Standard Form (SF) 294, Subcontracting Report for Individual Contracts, and/or SF 295, Summary Subcontract Report, in accordance with paragraph (j) of this clause. The reports shall provide information on subcontract awards to small business concerns, veteran-owned small business concerns, service-disabled veteran-owned small business concerns, HUBZone small business concerns, small disadvantaged business concerns, women-owned small business concerns, and Historically Black Colleges and Universities and Minority Institutions. Reporting shall be in accordance with the instructions on the forms or as provided in agency regulations.

(iv) Ensure that its subcontractors agree to submit SF 294 and SF 295.

(11) A description of the types of records that will be maintained concerning procedures that have been adopted to comply with the requirements and goals in the plan, including establishing source lists; and a description of the offeror's efforts to locate small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns and award subcontracts to them. The records shall include at least the following (on a plant-wide or company-wide basis, unless otherwise indicated):

(i) Source lists (e.g., PRO-Net), guides, and other data that identify small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns.

(ii) Organizations contacted in an attempt to locate sources that are small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, or women-owned small business concerns.

(iii) Records on each subcontract solicitation resulting in an award of more than \$100,000, indicating—

(A) Whether small business concerns were solicited and, if not, why not;  
(B) Whether veteran-owned small business concerns were solicited and, if not,

why not;

(C) Whether service-disabled veteran-owned small business concerns were solicited and, if not, why not;

(D) Whether HUBZone small business concerns were solicited and, if not, why not;

(E) Whether small disadvantaged business concerns were solicited and, if not, why not;

(F) Whether women-owned small business concerns were solicited and, if not, why not; and

(G) If applicable, the reason award was not made to a small business concern.

(iv) Records of any outreach efforts to contact—

(A) Trade associations;

(B) Business development organizations;

(C) Conferences and trade fairs to locate small, HUBZone small, small disadvantaged, and women-owned small business sources; and

(D) Veterans service organizations.

(v) Records of internal guidance and encouragement provided to buyers through—

(A) Workshops, seminars, training, etc.; and

(B) Monitoring performance to evaluate compliance with the program's requirements.

(vi) On a contract-by-contract basis, records to support award data submitted by the offeror to the Government, including the name, address, and business size of each subcontractor. Contractors having commercial plans need not comply with this requirement.

(e) In order to effectively implement this plan to the extent consistent with efficient contract performance, the Contractor shall perform the following functions:

(1) Assist small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns by arranging solicitations, time for the preparation of bids, quantities, specifications, and delivery schedules so as to

facilitate the participation by such concerns. Where the Contractor's lists of potential small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business subcontractors are excessively long, reasonable effort shall be made to give all such small business concerns an opportunity to compete over a period of time.

(2) Provide adequate and timely consideration of the potentialities of small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns in all "make-or-buy" decisions.

(3) Counsel and discuss subcontracting opportunities with representatives of small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business firms.

(4) Provide notice to subcontractors concerning penalties and remedies for misrepresentations of business status as small, veteran-owned small business, HUBZone small, small disadvantaged, or women-owned small business for the purpose of obtaining a subcontract that is to be included as part or all of a goal contained in the Contractor's subcontracting plan.

(f) A master plan on a plant or division-wide basis that contains all the elements required by paragraph (d) of this clause, except goals, may be incorporated by reference as a part of the subcontracting plan required of the offeror by this clause; provided —

(1) The master plan has been approved;

(2) The offeror ensures that the master plan is updated as necessary and provides copies of the approved master plan, including evidence of its approval, to the Contracting Officer; and

(3) Goals and any deviations from the master plan deemed necessary by the Contracting Officer to satisfy the requirements of this contract are set forth in the individual subcontracting plan.

(g) A commercial plan is the preferred type of subcontracting plan for contractors furnishing commercial items. The commercial plan shall relate to the offeror's planned subcontracting generally, for both commercial and Government business, rather than solely to the Government contract. Commercial plans are also preferred for subcontractors that provide commercial items under a prime contract, whether or not the prime contractor is supplying a commercial item.

(h) Prior compliance of the offeror with other such subcontracting plans under previous contracts will be considered by the Contracting Officer in determining the responsibility of the offeror for award of the contract.

(i) The failure of the Contractor or subcontractor to comply in good faith with—

(1) The clause of this contract entitled "Utilization Of Small Business Concerns;" or

(2) An approved plan required by this clause, shall be a material breach of the contract.

(j) The Contractor shall submit the following reports:

(1) *Standard Form 294, Subcontracting Report for Individual Contracts*. This report shall be submitted to the Contracting Officer semiannually and at contract completion. The report covers subcontract award data related to this contract. This report is not required for commercial plans.

(2) *Standard Form 295, Summary Subcontract Report*. This report encompasses all of the contracts with the awarding agency. It must be submitted semi-annually for contracts with the Department of Defense and annually for contracts with civilian agencies. If the reporting activity is covered by a commercial plan, the reporting activity must report annually all subcontract awards under that plan. All reports submitted at the close of each fiscal year (both individual and commercial plans) shall include a breakout, in the Contractor's format, of subcontract awards, in whole dollars, to small disadvantaged business concerns by North American Industry Classification System (NAICS) Industry Subsector. For a commercial plan, the Contractor may obtain from each of its subcontractors a predominant NAICS Industry Subsector and report all awards to that subcontractor under its predominant NAICS Industry Subsector.

(End of clause)

**24. \*FAR 52.219-9 SMALL BUSINESS SUBCONTRACTING PLAN (JAN 2002) --ALTERNATE I (OCT 2001) [When Contracting By Sealed Bidding]**

(a) This clause does not apply to small business concerns.

(b) *Definitions*. As used in this clause—

"Commercial item" means a product or service that satisfies the definition of commercial item in section 2.101 of the Federal Acquisition Regulation.

“Commercial plan” means a subcontracting plan (including goals) that covers the offeror’s fiscal year and that applies to the entire production of commercial items sold by either the entire company or a portion thereof (e.g., division, plant, or product line).

“Individual contract plan” means a subcontracting plan that covers the entire contract period (including option periods), applies to a specific contract, and has goals that are based on the offeror’s planned subcontracting in support of the specific contract, except that indirect costs incurred for common or joint purposes may be allocated on a prorated basis to the contract.

“Master plan” means a subcontracting plan that contains all the required elements of an individual contract plan, except goals, and may be incorporated into individual contract plans, provided the master plan has been approved.

“Subcontract” means any agreement (other than one involving an employer-employee relationship) entered into by a Federal Government prime Contractor or subcontractor calling for supplies or services required for performance of the contract or subcontract.

(c) The apparent low bidder, upon request by the Contracting Officer, shall submit a subcontracting plan, where applicable, that separately addresses subcontracting with small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns. If the bidder is submitting an individual contract plan, the plan must separately address subcontracting with small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns, with a separate part for the basic contract and separate parts for each option (if any). The plan shall be included in and made a part of the resultant contract. The subcontracting plan shall be submitted within the time specified by the Contracting Officer. Failure to submit the subcontracting plan shall make the bidder ineligible for the award of a contract.

(d) The offeror's subcontracting plan shall include the following:

(1) Goals, expressed in terms of percentages of total planned subcontracting dollars, for the use of small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns as subcontractors. The offeror shall include all subcontracts that contribute to contract performance, and may include a proportionate share of products and services that are normally allocated as indirect costs.

(2) A statement of—

(i) Total dollars planned to be subcontracted for an individual contract plan; or the offeror’s total projected sales, expressed in dollars, and the total value of projected subcontracts to support the sales for a commercial plan;

(ii) Total dollars planned to be subcontracted to small business concerns;

(iii) Total dollars planned to be subcontracted to veteran-owned small business concerns;

(iv) Total dollars planned to be subcontracted to service-disabled veteran-owned small business;

(v) Total dollars planned to be subcontracted to HUBZone small business concerns;

(vi) Total dollars planned to be subcontracted to small disadvantaged business concerns; and

(vii) Total dollars planned to be subcontracted to women-owned small business concerns.

(3) A description of the principal types of supplies and services to be subcontracted, and an identification of the types planned for subcontracting to—

(i) Small business concerns;

(ii) Veteran-owned small business concerns;

(iii) Service-disabled veteran-owned small business concerns;

(iv) HUBZone small business concerns;

(v) Small disadvantaged business concerns; and

(vi) Women-owned small business concerns.

(4) A description of the method used to develop the subcontracting goals in paragraph (d)(1) of this clause.

(5) A description of the method used to identify potential sources for solicitation purposes (e.g., existing company source lists, the Procurement Marketing and Access Network (PRO-Net) of the Small Business Administration (SBA), veterans service organizations, the National Minority Purchasing Council Vendor

Information Service, the Research and Information Division of the Minority Business Development Agency in the Department of Commerce, or small, HUBZone, small disadvantaged, and women-owned small business trade associations). A firm may rely on the information contained in PRO-Net as an accurate representation of a concern's size and ownership characteristics for the purposes of maintaining a small, veteran-owned small, service-disabled veteran-owned small, HUBZone small, small disadvantaged, and women-owned small business source list. Use of PRONet as its source list does not relieve a firm of its responsibilities (*e.g.*, outreach, assistance, counseling, or publicizing subcontracting opportunities) in this clause.

(6) A statement as to whether or not the offeror included indirect costs in establishing subcontracting goals, and a description of the method used to determine the proportionate share of indirect costs to be incurred with—

- (i) Small business concerns;
- (ii) Veteran-owned small business concerns;
- (iii) Service-disabled veteran-owned small business concerns;
- (iv) HUBZone small business concerns;
- (v) Small disadvantaged business concerns; and
- (vi) Women-owned small business concerns.

(7) The name of the individual employed by the offeror who will administer the offeror's subcontracting program, and a description of the duties of the individual.

(8) A description of the efforts the offeror will make to assure that small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns have an equitable opportunity to compete for subcontracts.

(9) Assurances that the offeror will include the clause of this contract entitled "Utilization of Small Business Concerns" in all subcontracts that offer further subcontracting opportunities, and that the offeror will require all subcontractors (except small business concerns) that receive subcontracts in excess of \$500,000 (\$1,000,000 for construction of any public facility) to adopt a subcontracting plan that complies with the requirements of this clause.

(10) Assurances that the offeror will—

- (i) Cooperate in any studies or surveys as may be required;
- (ii) Submit periodic reports so that the Government can determine the extent of compliance by the offeror with the subcontracting plan;
- (iii) Submit Standard Form (SF) 294, Subcontracting Report for Individual Contracts, and/or SF 295, Summary Subcontract Report, in accordance with paragraph (j) of this clause. The reports shall provide information on subcontract awards to small business concerns, veteran-owned small business concerns, service-disabled veteran-owned small business concerns, HUBZone small business concerns, small disadvantaged business concerns, women-owned small business concerns, and Historically Black Colleges and Universities and Minority Institutions. Reporting shall be in accordance with the instructions on the forms or as provided in agency regulations.

(iv) Ensure that its subcontractors agree to submit SF 294 and SF 295.

(11) A description of the types of records that will be maintained concerning procedures that have been adopted to comply with the requirements and goals in the plan, including establishing source lists; and a description of the offeror's efforts to locate small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns and award subcontracts to them. The records shall include at least the following (on a plant-wide or company-wide basis, unless otherwise indicated):

(i) Source lists (*e.g.*, PRO-Net), guides, and other data that identify small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns.

(ii) Organizations contacted in an attempt to locate sources that are small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, or women-owned small business concerns.

(iii) Records on each subcontract solicitation resulting in an award of more than \$100,000, indicating—

- (A) Whether small business concerns were solicited and, if not, why not;
- (B) Whether veteran-owned small business concerns were solicited and, if not,

why not;

solicited and, if not, why not;

not;

why not;

why not; and

(C) Whether service-disabled veteran-owned small business concerns were

(D) Whether HUBZone small business concerns were solicited and, if not, why

(E) Whether small disadvantaged business concerns were solicited and, if not,

(F) Whether women-owned small business concerns were solicited and, if not,

(G) If applicable, the reason award was not made to a small business concern.

(iv) Records of any outreach efforts to contact—

(A) Trade associations;

(B) Business development organizations;

(C) Conferences and trade fairs to locate small, HUBZone small, small disadvantaged, and women-owned small business sources; and

(D) Veterans service organizations.

(v) Records of internal guidance and encouragement provided to buyers through—

(A) Workshops, seminars, training, etc.; and

(B) Monitoring performance to evaluate compliance with the program's requirements.

(vi) On a contract-by-contract basis, records to support award data submitted by the offeror to the Government, including the name, address, and business size of each subcontractor. Contractors having commercial plans need not comply with this requirement.

(e) In order to effectively implement this plan to the extent consistent with efficient contract performance, the Contractor shall perform the following functions:

(1) Assist small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns by arranging solicitations, time for the preparation of bids, quantities, specifications, and delivery schedules so as to facilitate the participation by such concerns. Where the Contractor's lists of potential small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business subcontractors are excessively long, reasonable effort shall be made to give all such small business concerns an opportunity to compete over a period of time.

(2) Provide adequate and timely consideration of the potentialities of small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns in all "make-or-buy" decisions.

(3) Counsel and discuss subcontracting opportunities with representatives of small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business firms.

(4) Provide notice to subcontractors concerning penalties and remedies for misrepresentations of business status as small, veteran-owned small business, HUBZone small, small disadvantaged, or women-owned small business for the purpose of obtaining a subcontract that is to be included as part or all of a goal contained in the Contractor's subcontracting plan.

(f) A master plan on a plant or division-wide basis that contains all the elements required by paragraph (d) of this clause, except goals, may be incorporated by reference as a part of the subcontracting plan required of the offeror by this clause; provided —

(1) The master plan has been approved;

(2) The offeror ensures that the master plan is updated as necessary and provides copies of the approved master plan, including evidence of its approval, to the Contracting Officer; and

(3) Goals and any deviations from the master plan deemed necessary by the Contracting Officer to satisfy the requirements of this contract are set forth in the individual subcontracting plan.

(g) A commercial plan is the preferred type of subcontracting plan for contractors furnishing commercial items. The commercial plan shall relate to the offeror's planned subcontracting generally, for both commercial and Government business, rather than solely to the Government contract. Commercial plans are also preferred for subcontractors that provide commercial items under a prime contract, whether or not the prime contractor is

supplying a commercial item.

(h) Prior compliance of the offeror with other such subcontracting plans under previous contracts will be considered by the Contracting Officer in determining the responsibility of the offeror for award of the contract.

(i) The failure of the Contractor or subcontractor to comply in good faith with—

(1) The clause of this contract entitled “Utilization Of Small Business Concerns;” or

(2) An approved plan required by this clause, shall be a material breach of the contract.

(j) The Contractor shall submit the following reports:

(1) *Standard Form 294, Subcontracting Report for Individual Contracts*. This report shall be submitted to the Contracting Officer semiannually and at contract completion. The report covers subcontract award data related to this contract. This report is not required for commercial plans.

(2) *Standard Form 295, Summary Subcontract Report*. This report encompasses all of the contracts with the awarding agency. It must be submitted semi-annually for contracts with the Department of Defense and annually for contracts with civilian agencies. If the reporting activity is covered by a commercial plan, the reporting activity must report annually all subcontract awards under that plan. All reports submitted at the close of each fiscal year (both individual and commercial plans) shall include a breakout, in the Contractor’s format, of subcontract awards, in whole dollars, to small disadvantaged business concerns by North American Industry Classification System (NAICS) Industry Subsector. For a commercial plan, the Contractor may obtain from each of its subcontractors a predominant NAICS Industry Subsector and report all awards to that subcontractor under its predominant NAICS Industry Subsector.

(End of clause)

**25. DFARS 252.219-7009 SECTION 8(a) DIRECT AWARD (MAR 2002) [When Competitive 8(a) Contracting Procedures are used]**

(a) This contract is issued as a direct award between the contracting office and the 8(a) Contractor pursuant to the Partnership Agreement dated February 1, 2002, between the Small Business Administration (SBA) and the Department of Defense. Accordingly, the SBA, even if not identified in Section A of this contract, is the prime contractor and retains responsibility for 8(a) certification, for 8(a) eligibility determinations and related issues, and for providing counseling and assistance to the 8(a) Contractor under the 8(a) Program. The cognizant SBA district office is:

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[To be completed by the Contracting Officer at the time of award]

(b) The contracting office is responsible for administering the contract and for taking any action on behalf of the Government under the terms and conditions of the contract; provided that the contracting office shall give advance notice to the SBA before it issues a final notice terminating performance, either in whole or in part, under the contract. The contracting office also shall coordinate with the SBA prior to processing any novation agreement. The contracting office may assign contract administration functions to a contract administration office.

(c) The 8(a) Contractor agrees that--

(1) It will notify the Contracting Officer, simultaneous with its notification to the SBA (as required by SBA's 8(a) regulations at 13 CFR 124.308), when the owner or owners upon whom 8(a) eligibility is based plan to relinquish ownership or control of the concern. Consistent with Section 407 of Pub. L. 100-656, transfer of

ownership or control shall result in termination of the contract for convenience, unless the SBA waives the requirement for termination prior to the actual relinquishing of ownership and control; and

(2) It will not subcontract the performance of any of the requirements of this contract without the prior written approval of the SBA and the Contracting Officer.

(End of clause)

**26. \*FAR 52.219-14 LIMITATIONS ON SUBCONTRACTING (DEC 1996) [For Small Business Set Aside Only]**

- (a) This clause does not apply to the unrestricted portion of a partial set-aside.
- (b) By submission of an offer and execution of a contract, the Offeror/Contractor agrees that in performance of the contract in the case of a contract for--
  - (1) Services (except construction). At least 50 percent of the cost of contract performance incurred for personnel shall be expended for employees of the concern.
  - (2) Supplies (other than procurement from a nonmanufacturer of such supplies). The concern shall perform work for at least 50 percent of the cost of manufacturing the supplies, not including the cost of materials.
  - (3) General construction. The concern will perform at least 15 percent of the cost of the contract, not including the cost of materials, with its own employees.
  - (4) Construction by special trade contractors. The concern will perform at least 25 percent of the cost of the contract, not including the cost of materials, with its own employees.

**27. \*FAR 52.219-16 LIQUIDATED DAMAGES-SUBCONTRACTING PLAN (JAN 1999)**

(a) Failure to make a good faith effort to comply with the subcontracting plan, as used in this clause, means a willful or intentional failure to perform in accordance with the requirements of the subcontracting plan approved under the clause in this contract entitled "Small Business Subcontracting Plan," or willful or intentional action to frustrate the plan.

(b) Performance shall be measured by applying the percentage goals to the total actual subcontracting dollars or, if a commercial plan is involved, to the pro rata share of actual subcontracting dollars attributable to Government contracts covered by the commercial plan. If, at contract completion, or in the case of a commercial plan, at the close of the fiscal year for which the plan is applicable, the Contractor has failed to meet its subcontracting goals and the Contracting Officer decides in accordance with paragraph (c) of this clause that the Contractor failed to make a good faith effort to comply with its subcontracting plan, established in accordance with the clause in this contract entitled "Small Business Subcontracting Plan," the Contractor shall pay the Government liquidated damages in an amount stated. The amount of probable damages attributable to the Contractor's failure to comply shall be an amount equal to the actual dollar amount by which the Contractor failed to achieve each subcontract goal.

(c) Before the Contracting Officer makes a final decision that the Contractor has failed to make such good faith effort, the Contracting Officer shall give the Contractor written notice specifying the failure and permitting the Contractor to demonstrate what good faith efforts have been made and to discuss the matter. Failure to respond to the notice may be taken as an admission that no valid explanation exists. If, after consideration of all the pertinent data, the Contracting Officer finds that the Contractor failed to make a good faith effort to comply with the subcontracting plan, the Contracting Officer shall issue a final decision to that effect and require that the Contractor pay the Government liquidated damages as provided in paragraph (b) of this clause.

(d) With respect to commercial plans, the Contracting Officer who approved the plan will perform the functions of the Contracting Officer under this clause on behalf of all agencies with contracts covered by a commercial plan.

- (e) The Contractor shall have the right of appeal, under the clause in this contract entitled, Disputes, from many final decision of the Contracting Officer.
- (f) Liquidated damages shall be in addition to any other remedies that the Government may have.

**28. DFARS 252.219-7010                    ALTERNATE A (JUN 1998) [When Competitive 8(a) Contracting Procedures are used]**

As prescribed in 219.811-3(2), substitute the following paragraph (c) for paragraph (c) of the clause at FAR 52.219-18:

(c) Any award resulting from this solicitation will be made directly by the Contracting Officer to the successful 8(a) offeror selected through the evaluation criteria set forth in this solicitation.

**29. FAR 52.219-18                    NOTIFICATION OF COMPETITION LIMITED TO ELIGIBLE 8(A) CONCERNS (JUNE 1999) [When Competitive 8(a) Contracting Procedures are used]**

(a) Offers are solicited only from small business concerns expressly certified by the Small Business Administration (SBA) for participation in the SBA's 8(a) Program and which meet the following criteria at the time of submission of offer--

(1) The Offeror is in conformance with the 8(a) support limitation set forth in its approved business plan; and

(2) The Offeror is in conformance with the Business Activity Targets set forth in its approved business plan or any remedial action directed by the SBA.

(b) By submission of its offer, the Offeror represents that it meets all of the criteria set forth in paragraph (a) of this clause.

(c) Any award resulting from this solicitation will be made to the Small Business Administration, which will subcontract performance to the successful 8(a) offeror selected through the evaluation criteria set forth in this solicitation.

(d) (1) Agreement. A small business concern submitting an offer in its own name agrees to furnish, in performing the contract, only end items manufactured or produced by small business concerns in the United States. The term "United States" includes its territories and possessions, the Commonwealth of Puerto Rico, the Trust Territory of the Pacific Islands, and the District of Columbia. If this procurement is processed under simplified acquisition procedures and the total amount of this contract does not exceed \$25,000, a small business concern may furnish the product of any domestic firm. This subparagraph does not apply in connection with construction or service contracts.

(2) The . . . . . [insert name of SBA's contractor] will notify the U.S. Army Corps of Engineers Contracting Officer in writing immediately upon entering an agreement (either oral or written) to transfer all or part of its stock or other ownership interest to any other party.

(End of clause)

**30. DFARS 252.219-7003                    SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL BUSINESS SUBCONTRACTING PLAN (DOD CONTRACTS) (APR 1996)**

This clause supplements the Federal Acquisition Regulation 52.219-9, Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan, clause of this contract.

(a) Definitions.

"Historically black colleges and universities," as used in this clause, means institutions determined by the Secretary of Education to meet the requirements of 34 CFR Section 608.2. The term also means any nonprofit research institution that was an integral part of such a college or university before November 14, 1986.

"Minority institutions," as used in this clause, means institutions meeting the requirements of Section 1046(3) of the Higher Education Act of 1965 (20 U.S.C. 1135d-5(3)). The term also includes Hispanic-serving institutions as defined in Section 316(b)(1) of such Act (20 U.S.C. 1059c(b)(1)).

(b) Except for company or division-wide commercial products subcontracting plans, the term "small disadvantaged business," when used in the FAR 52.219-9 clause, includes historically black colleges and universities and minority institutions in addition to small disadvantaged business concerns.

(c) Work under the contract or its subcontracts shall be credited toward meeting the small disadvantaged business concern goal required by paragraph (d) of the FAR 52.219-9 clause when:

(1) It is performed on Indian lands or in joint venture with an Indian tribe or a tribally-owned corporation, and

(2) It meets the requirements of 10 U.S.C. 2323a.

(d) Subcontracts awarded to workshops approved by the Committee for Purchase from People Who are Blind or Severely Disabled (41 U.S.C. 46-48), may be counted toward the Contractor's small business subcontracting goal.

(e) A mentor firm, under the Pilot Mentor-Protege Program established under Section 831 of Pub. L. 101-510, as amended, may count toward its small disadvantaged business goal, subcontracts awarded--

(1) Protege firms which are qualified organizations employing the severely handicapped; and

(2) Former protege firms that meet the criteria in Section 831(g)(4) of Pub. L. 101-510.

(f) The master plan approval referred to in paragraph (f) of the FAR 52.219-9 clause is approval by the Contractor's cognizant contract administration activity.

(g) In those subcontracting plans which specifically identify small, small disadvantaged, and women-owned businesses, the Contractor shall notify the Administrative Contracting Officer of any substitutions of firms that are not small, small disadvantaged, or women-owned small businesses for the firms listed in the subcontracting plan. Notifications shall be in writing and shall occur within a reasonable period of time after award of the subcontract. Contractor-specified formats shall be acceptable.

### **31. DFARS 252.219-7004 SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL BUSINESS SUBCONTRACTING PLAN (TEST PROGRAM) (JUN 1997)**

(a) Definition. "Subcontract," as used in this clause, means any agreement (other than one involving an employer-employee relationship) entered into by a Federal Government prime Contractor or subcontractor calling for supplies or services required for performance of the contract or subcontract.

(b) The Offeror's comprehensive small business subcontracting plan and its successors, which are authorized by and approved under the test program of Section 834 of Pub. L. 101-189, shall be included in and made a part of the resultant contract. Upon expulsion from the test program or expiration of the test program, the Contractor shall negotiate an individual subcontracting plan for all future contracts that meet the requirements of Section 211 of Publ. L. 95-507.

(c) The Contractor shall submit Standard Form 295, Summary Subcontract Report, in accordance with the instructions on the form, except--

(1) One copy of SF 295 and attachments shall be submitted to Director, Small and Disadvantaged Business Utilization, Office of the Deputy Under Secretary of Defense (International and Commercial Programs), 3061 Defense Pentagon, Room 2A338, Washington, DC 20301-3061; and

(2) Item 14, Remarks, shall be completed to include semi-annual cumulative--

(1) Small business, small disadvantaged business and women-owned small business goals; and

(2) Small business and small disadvantaged business goals, actual accomplishments, and percentages for each of the two designated industry categories.

(d) The failure of the Contractor or subcontractor to comply in good faith with (1) the clause of this contract entitled "Utilization of Small, Small Disadvantaged and Women-Owned Small Business Concerns," or (2) an approved plan required by this clause, shall be a material breach of the contract.

**32. \*FAR 52.222-3 CONVICT LABOR (AUG 1996)**

The Contractor agrees not to employ in the performance of this contract any person undergoing a sentence of imprisonment which has been imposed by any court of a State, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, or the Trust Territory of the Pacific Islands. This limitation, however, shall not prohibit the employment by the Contractor in the performance of this contract of persons on parole or probation to work at paid employment during the term of their sentence or persons who have been pardoned or who have served their terms. Nor shall it prohibit the employment by the Contractor in the performance of this contract of persons confined for violation of the laws of any of the States, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, or the Trust Territory of the Pacific Islands who are authorized to work at paid employment in the community under the laws of such jurisdiction, if--

- (a) (1) The worker is paid or is in an approved work training program on a voluntary basis;
  - (2) Representatives of local union central bodies or similar labor union organizations have been consulted;
  - (3) Such paid employment will not result in the displacement of employed workers, or be applied in skills, crafts, or trades in which there is a surplus of available gainful labor in the locality, or impair existing contracts for services; and
  - (4) The rates of pay and other conditions of employment will not be less than those paid or provided for work of a similar nature in the locality in which the work is being performed; and
- (b) The Attorney General of the United States has certified that the work-release laws or regulations of the jurisdiction involved are in conformity with the requirements of Executive Order 11755, as amended by Executive Orders 12608 and 12943.

**33. \*FAR 52.222-4 CONTRACT WORK HOURS AND SAFETY STANDARDS ACT—OVERTIME COMPENSATION (SEPT 2000)**

(a) *Overtime requirements.* No Contractor or subcontractor employing laborers or mechanics (see Federal Acquisition Regulation 22.300) shall require or permit them to work over 40 hours in any workweek unless they are paid at least 1 and 1/2 times the basic rate of pay for each hour worked over 40 hours.

(b) *Violation; liability for unpaid wages; liquidated damages.* The responsible Contractor and subcontractor are liable for unpaid wages if they violate the terms in paragraph (a) of this clause. In addition, the Contractor and subcontractor are liable for liquidated damages payable to the Government. The Contracting Officer will assess liquidated damages at the rate of \$10 per affected employee for each calendar day on which the employer required or permitted the employee to work in excess of the standard workweek of 40 hours without paying overtime wages required by the Contract Work Hours and Safety Standards Act.

(c) *Withholding for unpaid wages and liquidated damages.* The Contracting Officer will withhold from payments due under the contract sufficient funds required to satisfy any Contractor or subcontractor liabilities for unpaid wages and liquidated damages. If amounts withheld under the contract are insufficient to satisfy Contractor or subcontractor liabilities, the Contracting Officer will withhold payments from other Federal or Federally assisted contracts held by the same Contractor that are subject to the Contract Work Hours and Safety Standards Act.

(d) *Payrolls and basic records.* (1) The Contractor and its subcontractors shall maintain payrolls and basic payroll records for all laborers and mechanics working on the contract during the contract and shall make them available to the Government until 3 years after contract completion. The records shall contain the name and address of each employee, social security number, labor classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. The records need not duplicate those required for construction work by Department of Labor regulations at 29 CFR 5.5(a)(3) implementing the Davis-Bacon Act .

(2) The Contractor and its subcontractors shall allow authorized representatives of the Contracting Officer or the Department of Labor to inspect, copy, or transcribe records maintained under paragraph (d)(1) of this clause. The Contractor or subcontractor also shall allow authorized representatives of the Contracting Officer or Department of Labor to interview employees in the workplace during working hours.

(e) *Subcontracts.* The Contractor shall insert the provisions set forth in paragraphs (a) through (d) of this

clause in subcontracts exceeding \$100,000 and require subcontractors to include these provisions in any lower-tier subcontracts. The Contractor shall be responsible for compliance by any subcontractor or lower-tier subcontractor with the provisions set forth in paragraphs (a) through (d) of this clause.  
(End of clause)

**34. \*FAR 52.222-6 DAVIS-BACON ACT (FEB 1995)**

(a) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR Part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (d) of this clause; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such period. Such laborers and mechanics shall be paid not less than the appropriate wage rate and fringe benefits in the wage determination for the classification of work actually performed, without regard to skill, except as provided in the clause entitled Apprentices and Trainees. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein; provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph (b) of this clause) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the Contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(b) (1) The Contracting Officer shall require that any class of laborers or mechanics, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The Contracting Officer shall approve an additional classification and wage rate and fringe benefits therefor only when all the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination.

(ii) The classification is utilized in the area by the construction industry.

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) If the Contractor and laborers and mechanics to be employed in the classification (if known), or their representatives, and the Contracting Officer agree on the classification and wage rate (including the amount designated for fringe benefits, where appropriate), a report of the action taken shall be sent by the Contracting Officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator or an authorized representative will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.

(3) In the event the Contractor, the laborers or mechanics to be employed in the classification, or their representatives, and the Contracting Officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the Contracting Officer shall refer the questions, including the views of all interested parties and the recommendation of the Contracting Officer, to the Administrator of the Wage and Hour Division for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.

(4) The wage rate (including fringe benefits, where appropriate) determined pursuant to subparagraphs (b)(2) and (b)(3) of this clause shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(c) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(d) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program; provided, that the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

**35. \*FAR 52.222-7 WITHHOLDING OF FUNDS (FEB 1988)**

The Contracting Officer shall, upon his or her own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the Contractor under this contract or any other Federal contract with the same Prime Contractor, or any other Federally assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same Prime Contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

**36. \*FAR 52.222-8 PAYROLLS AND BASIC RECORDS (FEB 1988)**

(a) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of 3 years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made, and actual wages paid. Whenever the Secretary of Labor has found, under paragraph (d) of the clause entitled Davis-Bacon Act, that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(b) (1) The Contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the Contracting Officer. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under paragraph (a) of this clause. This information may be submitted in any form desired. Optional Form WH-347 (Federal Stock Number 029-005-00014-1) is available for this purpose and may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. The Prime Contractor is responsible for the submission of copies of payrolls by all subcontractors.

(2) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify--

(i) That the payroll for the payroll period contains the information required to be maintained under paragraph (a) of this clause and that such information is correct and complete;

(ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate,

either directly or indirectly, and that no deductions have been made either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in the Regulations, 29 CFR Part 3; and

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(3) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by subparagraph (b)(2) of this clause.

(4) The falsification of any of the certifications in this clause may subject the Contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 3729 of Title 31 of the United States Code.

(c) The Contractor or subcontractor shall make the records required under paragraph (a) of this clause available for inspection, copying, or transcription by the Contracting Officer or authorized representatives of the Contracting Officer or the Department of Labor. The Contractor or subcontractor shall permit the Contracting Officer or representatives of the Contracting Officer or the Department of Labor to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit required records or to make them available, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

### **37. \*FAR 52.222-9 APPRENTICES AND TRAINEES (FEB 1988)**

(a) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State Apprenticeship Agency recognized by the Bureau, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the Contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in this paragraph, shall be paid not less than the applicable wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a Contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Bureau of Apprenticeship and Training, or a State Apprenticeship Agency recognized by the Bureau, withdraws approval of an apprenticeship program, the Contractor will not longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(b) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater

than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed in the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate in the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate in the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate in the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(c) Equal employment opportunity. The utilization of apprentices, trainees, and journeymen under this clause shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

**38. \*FAR 52.222-10 COMPLIANCE WITH COPELAND ACT REQUIREMENTS (FEB 1988)**

The Contractor shall comply with the requirements of 29 CFR Part 3, which are hereby incorporated by reference in this contract.

**39. \*FAR 52.222-11 SUBCONTRACTS (LABOR STANDARDS) (FEB 1988)**

(a) The Contractor or subcontractor shall insert in any subcontracts the clauses entitled Davis-Bacon Act, Contract Work Hours and Safety Standards Act--Overtime Compensation, Apprentices and Trainees, Payrolls and Basic Records, Compliance with Copeland Act Requirements, Withholding of Funds, Subcontracts (Labor Standards), Contract Termination--Debarment, Disputes Concerning Labor Standards, Compliance with Davis-Bacon and Related Act Regulations, and Certification of Eligibility, and such other clauses as the Contracting Officer may, by appropriate instructions, require, and also a clause requiring subcontractors to include these clauses in any lower tier subcontracts. The Prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with all the contract clauses cited in this paragraph.

(b) (1) Within 14 days after award of the contract, the Contractor shall deliver to the Contracting Officer a completed Statement and Acknowledgment Form (SF 1413) for each subcontract, including the subcontractor's signed and dated acknowledgment that the clauses set forth in paragraph (a) of this clause have been included in the subcontract.

(2) Within 14 days after the award of any subsequently awarded subcontract the Contractor shall deliver to the Contracting Officer an updated completed SF 1413 for such additional subcontract.

**40. \*FAR 52.222-12 CONTRACT TERMINATION--DEBARMENT (FEB 1988)**

A breach of the contract clauses entitled Davis-Bacon Act, Contract Work Hours and Safety Standards Act--Overtime Compensation, Apprentices and Trainees, Payrolls and Basic Records, Compliance with Copeland Act Requirements, Subcontracts (Labor Standards), Compliance with Davis-Bacon and Related Act Regulations, or Certification of Eligibility may be grounds for termination of the contract, and for debarment as a Contractor and subcontractor as provided in 29 CFR 5.12.

**41. \*FAR 52.222-13 COMPLIANCE WITH DAVIS-BACON AND RELATED ACT REGULATIONS (FEB 1988)**

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are hereby incorporated by reference in this contract.

**42. \*FAR 52.222-14 DISPUTES CONCERNING LABOR STANDARDS (FEB 1988)**

The United States Department of Labor has set forth in 29 CFR Parts 5, 6, and 7 procedures for resolving disputes concerning labor standards requirements. Such disputes shall be resolved in accordance with those procedures and not the Disputes clause of this contract. Disputes within the meaning of this clause include disputes between the Contractor (or any of its subcontractors) and the contracting agency the U.S. Department of Labor, or the employees of their representatives.

**43. \*FAR 52.222-15 CERTIFICATION OF ELIGIBILITY (FEB 1988)**

(a) By entering into this contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(b) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(c) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

**44. \*FAR 52.222-26 EQUAL OPPORTUNITY (APR 2002)**

(a) *Definition.* "United States," as used in this clause, means the 50 States, the District of Columbia, Puerto Rico, the Northern Mariana Islands, American Samoa, Guam, the U.S. Virgin Islands, and Wake Island.

(b) If, during any 12-month period (including the 12 months preceding the award of this contract), the Contractor has been or is awarded nonexempt Federal contracts and/or subcontracts that have an aggregate value in excess of \$10,000, the Contractor shall comply with paragraphs (b)(1) through (b)(11) of this clause, except for work performed outside the United States by employees who were not recruited within the United States. Upon request, the Contractor shall provide information necessary to determine the applicability of this clause.

(1) The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. However, it shall not be a violation of this clause for the Contractor to extend a publicly announced preference in employment to Indians living on or near an Indian reservation, in connection with employment opportunities on or near an Indian reservation, as permitted by 41 CFR 60-1.5.

(2) The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. This shall include, but not be limited to—

- (i) Employment;
- (ii) Upgrading;
- (iii) Demotion;
- (iv) Transfer;
- (v) Recruitment or recruitment advertising;
- (vi) Layoff or termination;
- (vii) Rates of pay or other forms of compensation; and
- (viii) Selection for training, including apprenticeship.

(3) The Contractor shall post in conspicuous places available to employees and applicants for employment the notices to be provided by the Contracting Officer that explain this clause.

(4) The Contractor shall, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(5) The Contractor shall send, to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, the notice to be provided by the Contracting Officer advising the labor union or workers' representative of the Contractor's commitments under this clause, and post copies of the notice in conspicuous places available to employees and applicants for employment.

(6) The Contractor shall comply with Executive Order 11246, as amended, and the rules, regulations, and orders of the Secretary of Labor.

(7) The Contractor shall furnish to the contracting agency all information required by Executive Order 11246, as amended, and by the rules, regulations, and orders of the Secretary of Labor. The Contractor shall also file Standard Form 100 (EEO-1), or any successor form, as prescribed in 41 CFR part 60-1. Unless the Contractor has filed within the 12 months preceding the date of contract award, the Contractor shall, within 30 days after contract award, apply to either the regional Office of Federal Contract Compliance Programs (OFCCP) or the local office of the Equal Employment Opportunity Commission for the necessary forms.

(8) The Contractor shall permit access to its premises, during normal business hours, by the contracting agency or the OFCCP for the purpose of conducting on-site compliance evaluations and complaint investigations. The Contractor shall permit the Government to inspect and copy any books, accounts, records (including computerized records), and other material that may be relevant to the matter under investigation and pertinent to compliance with Executive Order 11246, as amended, and rules and regulations that implement the Executive Order.

(9) If the OFCCP determines that the Contractor is not in compliance with this clause or any rule, regulation, or order of the Secretary of Labor, this contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts, under the procedures authorized in Executive Order 11246, as amended. In addition, sanctions may be imposed and remedies invoked against the Contractor as provided in Executive Order 11246, as amended; in the rules, regulations, and orders of the Secretary of Labor; or as otherwise provided by law.

(10) The Contractor shall include the terms and conditions of paragraphs (b)(1) through (11) of this clause in every subcontract or purchase order that is not exempted by the rules, regulations, or orders of the Secretary of Labor issued under Executive Order 11246, as amended, so that these terms and conditions will be binding upon each subcontractor or vendor.

(11) The Contractor shall take such action with respect to any subcontract or purchase order as the Contracting Officer may direct as a means of enforcing these terms and conditions, including sanctions for noncompliance, provided, that if the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of any direction, the Contractor may request the United States to enter into the litigation to protect the interests of the United States.

(c) Notwithstanding any other clause in this contract, disputes relative to this clause will be governed by the procedures in 41 CFR 60-1.1.

(End of clause)

#### **45. \*FAR 52.222-27 AFFIRMATIVE ACTION COMPLIANCE REQUIREMENTS FOR CONSTRUCTION (FEB 1999)**

(a) Definitions.

"Covered area," as used in this clause, means the geographical area described in the solicitation for this contract.

"Deputy Assistant Secretary," as used in this clause, means the Deputy Assistant Secretary for Federal Contract Compliance, U.S. Department of Labor, or a designee

"Employer's identification number," as used in this clause, means the Federal Social Security number used on the employer's quarterly Federal tax return, U.S. Treasury Department Form 941.

"Minority," as used in this clause, means--

(1) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

(2) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands);

(3) Black (all persons having origins in any of the black African racial groups not of Hispanic origin); and

(4) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race).

(b) If the Contractor, or a subcontractor at any tier, subcontracts a portion of the work involving any construction trade each such subcontract in excess of \$10,000 shall include this clause and the Notice containing the goals for minority and female participation stated in the solicitation for this contract.

(c) If the Contractor is participating in a Hometown Plan (41 CFR 60-4) approved by the U.S. Department of Labor in a covered area, either individually or through an association, its affirmative action obligations on all work in the plan area (including goals) shall comply with the plan for those trades that have unions participating in the plan. Contractors must be able to demonstrate participation in, and compliance with, the provisions of the plan. Each Contractor or subcontractor participating in an approved plan is also required to comply with its obligations under the Equal Opportunity clause, and to make a good faith effort to achieve each goal under the plan in each trade in which it has employees. The overall good-faith performance by other Contractors or subcontractors toward a goal in an approved plan does not excuse any Contractor's or subcontractor's failure to make good-faith efforts to achieve the plan's goals.

(d) The Contractor shall implement the affirmative action procedures in subparagraphs (g)(1) through (16) of this clause. The goals stated in the solicitation for this contract are expressed as percentages of the total hours of employment and training of minority and female utilization that the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for the geographical area where that work is actually performed. The Contractor is expected to make substantially uniform progress toward its goals in each craft.

(e) Neither the terms and conditions of any collective bargaining agreement, nor the failure by a union with which the Contractor has a collective bargaining agreement, to refer minorities or women shall excuse the Contractor's obligations under this clause, Executive Order 11246, as amended, or the regulations thereunder.

(f) In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

(g) The Contractor shall take affirmative action to ensure equal employment opportunity. The evaluation of the Contractor's compliance with this clause shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully and implement affirmative action steps at least as extensive as the following:

(1) Ensure a working environment free of harassment, intimidation, and coercion at all sites and in all facilities where the Contractor's employees are assigned to work. The Contractor, if possible, will assign two or more women to each construction project. The Contractor shall ensure that foremen, superintendents, and other onsite supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at these sites or facilities.

(2) Establish and maintain a current list of sources for minority and female recruitment. Provide written notification to minority and female recruitment sources and community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

(3) Establish and maintain a current file of the names, addresses, and telephone numbers of each minority and female off-the-street applicant, referrals of minorities or females from unions, recruitment sources, or community organizations, and the action taken with respect to each individual. If an individual was sent to the union hiring hall for referral and not referred back to the Contractor by the union or, if referred back, not employed by the Contractor, this shall be documented in the file, along with whatever additional actions the Contractor may have taken.

(4) Immediately notify the Deputy Assistant Secretary when the union or unions with which the Contractor has a collective bargaining agreement has not referred back to the Contractor a minority or woman

sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

(5) Develop on-the-job training opportunities and/or participate in training programs for the area that expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under subparagraph (g)(2) of this clause.

(6) Disseminate the Contractor's equal employment policy by--

- (i) Providing notice of the policy to unions and to training, recruitment, and outreach programs, and requesting their cooperation in assisting the Contractor in meeting its contract obligations;
- (ii) Including the policy in any policy manual and in collective bargaining agreements;
- (iii) Publicizing the policy in the company newspaper, annual report, etc.;
- (iv) Reviewing the policy with all management personnel and with all minority and female employees at least once a year; and
- (v) Posting the policy on bulletin boards accessible to employees at each location where construction work is performed.

(7) Review, at least annually, the Contractor's equal employment policy and affirmative action obligations with all employees having responsibility for hiring, assignment, layoff, termination, or other employment decisions. Conduct review of this policy with all on-site supervisory personnel before initiating construction work at a job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

(8) Disseminate the Contractor's equal employment policy externally by including it in any advertising in the news media, specifically including minority and female news media. Provide written notification to, and discuss this policy with, other Contractors and subcontractors with which the Contractor does or anticipates doing business.

(9) Direct recruitment efforts, both oral and written, to minority, female, and community organizations, to schools with minority and female students, and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than 1 month before the date for acceptance of applications for apprenticeship or training by any recruitment source, send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

(10) Encourage present minority and female employees to recruit minority persons and women. Where reasonable, provide after-school, summer, and vacation employment to minority and female youth both on the site and in other areas of the Contractor's workforce.

(11) Validate all tests and other selection requirements where required under 41 CFR 60-3.

(12) Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities. Encourage these employees to seek or to prepare for, through appropriate training, etc., opportunities for promotion.

(13) Ensure that seniority practices job classifications, work assignments, and other personnel practices do not have a discriminatory effect by continually monitoring all personnel and employment-related activities to ensure that the Contractor's obligations under this contract are being carried out.

(14) Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

(15) Maintain a record of solicitations for subcontracts for minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

(16) Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's equal employment policy and affirmative action obligations.

(h) The Contractor is encouraged to participate in voluntary associations that may assist in fulfilling one or more of the affirmative action obligations contained in subparagraphs (g)(1) through (16) of this clause. The efforts of a contractor association, joint contractor-union, contractor-community, or similar group of which the contractor is a member and participant may be asserted as fulfilling one or more of its obligations under subparagraphs (g)(1) through (16) of this clause, provided the Contractor--

- (1) Actively participates in the group;
- (2) Makes every effort to ensure that the group has a positive impact on the employment of minorities and women in the industry;
- (3) Ensures that concrete benefits of the program are reflected in the Contractor's minority and female workforce participation;
- (4) Makes a good-faith effort to meet its individual goals and timetables; and
- (5) Can provide access to documentation that demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply is the Contractor's, and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

(i) A single goal for minorities and a separate single goal for women shall be established. The Contractor is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and nonminority. Consequently, the Contractor may be in violation of Executive Order 11246, as amended, if a particular group is employed in a substantially disparate manner.

(j) The Contractor shall not use goals or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

(k) The Contractor shall not enter into any subcontract with any person or firm debarred from Government contracts under Executive Order 11246, as amended.

(l) The Contractor shall carry out such sanctions and penalties for violation of this clause and of the Equal Opportunity clause, including suspension, termination, and cancellation of existing subcontracts, as may be imposed or ordered under Executive Order 11246, as amended, and its implementing regulations, by the OFCCP. Any failure to carry out these sanctions and penalties as ordered shall be a violation of this clause and Executive Order 11246, as amended.

(m) The Contractor in fulfilling its obligations under this clause shall implement affirmative action procedures at least as extensive as those prescribed in paragraph (g) of this clause, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of Executive Order 11246, as amended, the implementing regulations, or this clause, the Deputy Assistant Secretary shall take action as prescribed in 41 CFR 60-4.8.

(n) The Contractor shall designate a responsible official to--

(1) Monitor all employment-related activity to ensure that the Contractor's equal employment policy is being carried out;

(2) Submit reports as may be required by the Government; and

(3) Keep records that shall at least include for each employee the name, address, telephone number, construction trade, union affiliation (if any), employee identification number, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, separate records are not required to be maintained.

(o) Nothing contained herein shall be construed as a limitation upon the application of other laws that establish different standards of compliance or upon the requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

#### **46. \*FAR 52.222-35 EQUAL OPPORTUNITY FOR SPECIAL DISABLED VETERANS, VETERANS OF THE VIETNAM ERA, AND OTHER ELIGIBLE VETERANS (DEC 2001)**

(a) *Definitions.* As used in this clause—

“All employment openings” means all positions except executive and top management, those positions that will be filled from within the Contractor's organization, and positions lasting 3 days or less. This term includes full-time employment, temporary employment of more than 3 days duration, and part-time employment.

“Executive and top management” means any employee—

(1) Whose primary duty consists of the management of the enterprise in which the individual is employed or of a customarily recognized department or subdivision thereof;

(2) Who customarily and regularly directs the work of two or more other employees;

(3) Who has the authority to hire or fire other employees or whose suggestions and recommendations as to the hiring or firing and as to the advancement and promotion or any other change of status of other employees will be given particular weight;

(4) Who customarily and regularly exercises discretionary powers; and

(5) Who does not devote more than 20 percent or, in the case of an employee of a retail or service establishment, who does not devote more than 40 percent of total hours of work in the work week to activities that are not directly and closely related to the performance of the work described in paragraphs (1) through (4) of this definition. This paragraph (5) does not apply in the case of an employee who is in sole charge of an establishment or a physically separated branch establishment, or who owns at least a 20 percent interest in the enterprise in which the individual is employed.

“Other eligible veteran” means any other veteran who served on active duty during a war or in a campaign or expedition for which a campaign badge has been authorized.

“Positions that will be filled from within the Contractor's organization” means employment openings for which the Contractor will give no consideration to persons outside the Contractor's organization (including any affiliates, subsidiaries, and parent companies) and includes any openings the Contractor proposes to fill from regularly established “recall” lists. The exception does not apply to a particular opening once an employer decides to consider applicants outside of its organization.

“Qualified special disabled veteran” means a special disabled veteran who satisfies the requisite skill, experience, education, and other job-related requirements of the employment position such veteran holds or desires, and who, with or without reasonable accommodation, can perform the essential functions of such position.

“Special disabled veteran” means—

(1) A veteran who is entitled to compensation (or who but for the receipt of military retired pay would be entitled to compensation) under laws administered by the Department of Veterans Affairs for a disability—

(i) Rated at 30 percent or more; or

(ii) Rated at 10 or 20 percent in the case of a veteran who has been determined under 38 U.S.C. 3106 to have a serious employment handicap (*i.e.*, a significant impairment of the veteran's ability to prepare for, obtain, or retain employment consistent with the veteran's abilities, aptitudes, and interests); or

(2) A person who was discharged or released from active duty because of a service-connected disability.

“Veteran of the Vietnam era” means a person who—

(1) Served on active duty for a period of more than 180 days and was discharged or released from active duty with other than a dishonorable discharge, if any part of such active duty occurred—

(i) In the Republic of Vietnam between February 28, 1961, and May 7, 1975; or

(ii) Between August 5, 1964, and May 7, 1975, in all other cases; or

(2) Was discharged or released from active duty for a service-connected disability if any part of the active duty was performed—

(i) In the Republic of Vietnam between February 28, 1961, and May 7, 1975; or

(ii) Between August 5, 1964, and May 7, 1975, in all other cases.

(b) *General.* (1) The Contractor shall not discriminate against the individual because the individual is a special disabled veteran, a veteran of the Vietnam era, or other eligible veteran, regarding any position for which the employee or applicant for employment is qualified. The Contractor shall take affirmative action to employ, advance in employment, and otherwise treat qualified special disabled veterans, veterans of the Vietnam era, and other eligible veterans without discrimination based upon their disability or veterans' status in all employment practices such as—

(i) Recruitment, advertising, and job application procedures;

(ii) Hiring, upgrading, promotion, award of tenure, demotion, transfer, layoff, termination, right of return from layoff and rehiring;

(iii) Rate of pay or any other form of compensation and changes in compensation;

(iv) Job assignments, job classifications, organizational structures, position descriptions, lines of progression, and seniority lists;

(v) Leaves of absence, sick leave, or any other leave;

(vi) Fringe benefits available by virtue of employment, whether or not administered by

the Contractor;

(vii) Selection and financial support for training, including apprenticeship, and on-the-job training under 38 U.S.C. 3687, professional meetings, conferences, and other related activities, and selection for leaves of absence to pursue training;

(viii) Activities sponsored by the Contractor including social or recreational programs;

and

(ix) Any other term, condition, or privilege of employment.

(2) The Contractor shall comply with the rules, regulations, and relevant orders of the Secretary of Labor issued under the Vietnam Era Veterans' Readjustment Assistance Act of 1972 (the Act), as amended (38 U.S.C. 4211 and 4212).

(c) *Listing openings.* (1) The Contractor shall immediately list all employment openings that exist at the time of the execution of this contract and those which occur during the performance of this contract, including those not generated by this contract, and including those occurring at an establishment of the Contractor other than the one where the contract is being performed, but excluding those of independently operated corporate affiliates, at an appropriate local public employment service office of the State wherein the opening occurs. Listing employment openings with the U.S. Department of Labor's America's Job Bank shall satisfy the requirement to list jobs with the local employment service office.

(2) The Contractor shall make the listing of employment openings with the local employment service office at least concurrently with using any other recruitment source or effort and shall involve the normal obligations of placing a bona fide job order, including accepting referrals of veterans and nonveterans. This listing of employment openings does not require hiring any particular job applicant or hiring from any particular group of job applicants and is not intended to relieve the Contractor from any requirements of Executive orders or regulations concerning nondiscrimination in employment.

(3) Whenever the Contractor becomes contractually bound to the listing terms of this clause, it shall advise the State public employment agency in each State where it has establishments of the name and location of each hiring location in the State. As long as the Contractor is contractually bound to these terms and has so advised the State agency, it need not advise the State agency of subsequent contracts. The Contractor may advise the State agency when it is no longer bound by this contract clause.

(d) *Applicability.* This clause does not apply to the listing of employment openings that occur and are filled outside the 50 States, the District of Columbia, the Commonwealth of Puerto Rico, the Commonwealth of the Northern Mariana Islands, American Samoa, Guam, the Virgin Islands of the United States, and Wake Island.

(e) *Postings.* (1) The Contractor shall post employment notices in conspicuous places that are available to employees and applicants for employment.

(2) The employment notices shall—

(i) State the rights of applicants and employees as well as the Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified employees and applicants who are special disabled veterans, veterans of the Vietnam era, and other eligible veterans; and

(ii) Be in a form prescribed by the Deputy Assistant Secretary for Federal Contract Compliance Programs, Department of Labor (Deputy Assistant Secretary of Labor), and provided by or through the Contracting Officer.

(3) The Contractor shall ensure that applicants or employees who are special disabled veterans are informed of the contents of the notice (e.g., the Contractor may have the notice read to a visually disabled veteran, or may lower the posted notice so that it can be read by a person in a wheelchair).

(4) The Contractor shall notify each labor union or representative of workers with which it has a collective bargaining agreement, or other contract understanding, that the Contractor is bound by the terms of the Act and is committed to take affirmative action to employ, and advance in employment, qualified special disabled veterans, veterans of the Vietnam era, and other eligible veterans.

(f) *Noncompliance.* If the Contractor does not comply with the requirements of this clause, the Government may take appropriate actions under the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Act.

(g) *Subcontracts.* The Contractor shall insert the terms of this clause in all subcontracts or purchase orders of \$25,000 or more unless exempted by rules, regulations, or orders of the Secretary of Labor. The Contractor shall act as specified by the Deputy Assistant Secretary of Labor to enforce the terms, including action for

noncompliance.  
(End of clause)

**47. \*FAR 52.222-36 AFFIRMATIVE ACTION FOR WORKERS WITH DISABILITIES (JUN 1998)**

(a) General.

(1) Regarding any position for which the employee or applicant for employment is qualified, the Contractor shall not discriminate against any employee or applicant because of physical or mental disability. The Contractor agrees to take affirmative action to employ, advance in employment, and otherwise treat qualified individuals with disabilities without discrimination based upon their physical or mental disability in all employment practices such as--

- (i) Recruitment, advertising, and job application procedures;
- (ii) Hiring, upgrading, promotion, award of tenure, demotion, transfer, layoff, termination, right of return from layoff, and rehiring;
- (iii) Rates of pay or other forms of compensation and changes in compensation;
- (iv) Job assignments, job classifications, organizational structures, position descriptions, lines of progression, and seniority lists;
- (v) Leaves of absence, sick leave, or any other leave;
- (vi) Fringe benefits available by virtue of employment, whether or not administered by the Contractor;
- (vii) Selection and financial support for training, including apprenticeships, professional meetings, conferences, and other related activities, and selection for leaves of absence to pursue training;
- (viii) Activities sponsored by the Contractor, including social or recreational programs; and
- (ix) Any other term, condition, or privilege of employment.

(2) The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor (Secretary) issued under the Rehabilitation Act of 1973 (29 U.S.C. 793) (the Act), as amended.

(b) Postings.

- (1) The Contractor agrees to post employment notices stating--
    - (i) The Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified individuals with disabilities; and
    - (ii) The rights of applicants and employees.
  - (2) These notices shall be posted in conspicuous places that are available to employees and applicants for employment. The Contractor shall ensure that applicants and employees with disabilities are informed of the contents of the notice (e.g., the Contractor may have the notice read to visually disabled individual, or may lower the posted notice so that it might be read by a person in a wheelchair). The notices shall be in a form prescribed by the Deputy Assistant Secretary for Federal Contract Compliance of the U.S. Department of Labor (Deputy Assistant Secretary) and shall be provided by or through the Contracting Officer.
  - (3) The Contractor shall notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the Contractor is bound by the terms of Section 503 of the Act and is committed to take affirmative action to employ, and advance in employment, qualified individuals with physical or mental disabilities.
- (c) Noncompliance. If the Contractor does not comply with the requirements of this clause, appropriate actions may be taken under the rules, regulations, and relevant orders of the Secretary issued pursuant to the Act.
- (d) Subcontracts. The Contractor shall include the terms of this clause in every subcontract or purchase order in excess of \$10,000 unless exempted by rules, regulations, or orders of the Secretary. The Contractor shall act as specified by the Deputy Assistant Secretary to enforce the terms, including action for noncompliance.

**48. \*FAR 52.222-37 EMPLOYMENT REPORTS ON SPECIAL DISABLED VETERANS, VETERANS OF THE VIETNAM ERA, AND OTHER ELIGIBLE VETERANS (DEC 2001)**

(a) Unless the Contractor is a State or local government agency, the Contractor shall report at least annually, as required by the Secretary of Labor, on—

(1) The number of special disabled veterans, the number of veterans of the Vietnam era, and other eligible veterans in the workforce of the Contractor by job category and hiring location; and

(2) The total number of new employees hired during the period covered by the report, and of the total, the number of special disabled veterans, the number of veterans of the Vietnam era, and the number of other eligible veterans; and

(3) The maximum number and the minimum number of employees of the Contractor during the period covered by the report.

(b) The Contractor shall report the above items by completing the Form VETS-100, entitled “Federal Contractor Veterans’ Employment Report (VETS-100 Report)”.

(c) The Contractor shall submit VETS-100 Reports no later than September 30 of each year beginning September 30, 1988.

(d) The employment activity report required by paragraph (a)(2) of this clause shall reflect total hires during the most recent 12-month period as of the ending date selected for the employment profile report required by paragraph (a)(1) of this clause. Contractors may select an ending date—

(1) As of the end of any pay period between July 1 and August 31 of the year the report is due; or

(2) As of December 31, if the Contractor has prior written approval from the Equal Employment Opportunity Commission to do so for purposes of submitting the Employer Information Report EEO-1 (Standard Form 100).

(e) The Contractor shall base the count of veterans reported according to paragraph (a) of this clause on voluntary disclosure. Each Contractor subject to the reporting requirements at 38 U.S.C. 4212 shall invite all special disabled veterans, veterans of the Vietnam era, and other eligible veterans who wish to benefit under the affirmative action program at 38 U.S.C. 4212 to identify themselves to the Contractor. The invitation shall state that—

(1) The information is voluntarily provided;

(2) The information will be kept confidential;

(3) Disclosure or refusal to provide the information will not subject the applicant or employee to any adverse treatment; and

(4) The information will be used only in accordance with the regulations promulgated under 38 U.S.C. 4212.

(f) The Contractor shall insert the terms of this clause in all subcontracts or purchase orders of \$25,000 or more unless exempted by rules, regulations, or orders of the Secretary of Labor.

(End of clause)

**49. \*FAR 52.222-38 COMPLIANCE WITH VETERANS’ EMPLOYMENT REPORTING REQUIREMENTS (DEC 2001)**

By submission of its offer, the offeror represents that, if it is subject to the reporting requirements of 38 U.S.C. 4212(d) (*i.e.*, if it has any contract containing Federal Acquisition Regulation clause 52.222-37, Employment Reports on Special Disabled Veterans, Veterans of the Vietnam Era, and Other Eligible Veterans), it has submitted the most recent VETS-100 Report required by that clause.

(End of provision)

**50. \*FAR 52.223-5 POLLUTION PREVENTION AND RIGHT-TO-KNOW INFORMATION (APR 1998) [For Work on Federal Facilities]**

(a) Executive Order 12856 of August 3, 1993, requires Federal facilities to comply with the provisions of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11001-11050) and the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13101-13109).

(b) The Contractor shall provide all information needed by the Federal facility to comply with the emergency planning reporting requirements of Section 302 of EPCRA; the emergency notice requirements of Section 304 of EPCRA; the list of Material Safety Data Sheets required by Section 311 of EPCRA; the emergency and hazardous chemical inventory forms of Section 312 of EPCRA; the toxic chemical release inventory of Section 313 of EPCRA, which includes the reduction and recycling information required by Section 6607 of PPA; and the toxic chemical reduction goals requirements of Section 3-302 of Executive Order 12856.

**51. \*FAR 52.223-6 DRUG-FREE WORKPLACE (MAY 2001)**

(a) Definitions. As used in this clause--

"Controlled substance" means a controlled substance in schedules I through V of section 202 of the Controlled Substances Act (21 U.S.C. 812) and as further defined in regulation at 21 CFR 1308.11 - 1308.15.

"Conviction" means a finding of guilt (including a plea of nolo contendere) or imposition of sentence, or both, by any judicial body charged with the responsibility to determine violations of the Federal or State criminal drug statutes.

"Criminal drug statute" means a Federal or non-Federal criminal statute involving the manufacture, distribution, dispensing, possession or use of any controlled substance.

"Drug-free workplace" means the site(s) for the performance of work done by the Contractor in connection with a specific contract where employees of the Contractor are prohibited from engaging in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance.

"Employee" means an employee of a Contractor directly engaged in the performance of work under a Government contract. "Directly engaged" is defined to include all direct cost employees and any other Contractor employee who has other than a minimal impact or involvement in contract performance.

"Individual" means an offeror/contractor that has no more than one employee including the offeror/contractor.

(b) The Contractor, if other than an individual, shall--within 30 days after award (unless a longer period is agreed to in writing for contracts of 30 days or more performance duration), or as soon as possible for contracts of less than 30 days performance duration--

(1) Publish a statement notifying its employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the Contractor's workplace and specifying the actions that will be taken against employees for violations of such prohibition;

(2) Establish an ongoing drug-free awareness program to inform such employees about--

(i) The dangers of drug abuse in the workplace;

(ii) The Contractor's policy of maintaining a drug-free workplace;

(iii) Any available drug counseling, rehabilitation, and employee assistance

programs; and

(iv) The penalties that may be imposed upon employees for drug abuse violations

occurring in the workplace.

(3) Provide all employees engaged in performance of the contract with a copy of the statement required by subparagraph (b)(1) of this clause;

(4) Notify such employees in writing in the statement required by subparagraph (b)(1) of this clause that, as a condition of continued employment on this contract, the employee will--

(i) Abide by the terms of the statement; and

(ii) Notify the employer in writing of the employee's conviction under a criminal drug statute for a violation occurring in the workplace no later than 5 days after such conviction.

(5) Notify the Contracting Officer in writing within 10 days after receiving notice under subdivision (b)(4)(ii) of this clause, from an employee or otherwise receiving actual notice of such conviction. The notice shall include the position title of the employee;

(6) Within 30 days after receiving notice under subdivision (b)(4)(ii) of this clause of a conviction, take one of the following actions with respect to any employee who is convicted of a drug abuse violation occurring in the workplace:

(i) Taking appropriate personnel action against such employee, up to and including termination; or

(ii) Require such employee to satisfactorily participate in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency; and

(7) Make a good faith effort to maintain a drug-free workplace through implementation of subparagraphs (b)(1) through (b)(6) of this clause.

(c) The Contractor, if an individual, agrees by award of the contract or acceptance of a purchase order, not to engage in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance while performing this contract.

(d) In addition to other remedies available to the Government, the Contractor's failure to comply with the requirements of paragraph (b) or (c) of this clause may, pursuant to FAR 23.560, render the Contractor subject to suspension of contract payments, termination of the contract for default, and suspension or debarment.

**52. FAR 52.223-9 ESTIMATE OF PERCENTAGE OF RECOVERED MATERIAL CONTENT FOR EPA-DESIGNATED PRODUCTS (AUG 2000) [For Contracts exceeding \$100,000. EPA Designated product (available at <http://www.epa.gov/cpg/>)]**

(a) Definitions. As used in this clause—

“Postconsumer material” means a material or finished product that has served its intended use and has been discarded for disposal or recovery, having completed its life as a consumer item. Postconsumer material is a part of the broader category of “recovered material.”

“Recovered material” means waste materials and by-products recovered or diverted from solid waste, but the term does not include those materials and by-products generated from, and commonly reused within, an original manufacturing process.

(b) The Contractor, on completion of this contract, shall—

(1) Estimate the percentage of the total recovered material used in contract performance, including, if applicable, the percentage of postconsumer material content; and

(2) Submit this estimate to the Contracting Officer.

(End of clause)

**53. \*FAR 52.223-14 TOXIC CHEMICAL RELEASE REPORTING (OCT 2000) [For Contracts Over \$100,000]**

(a) Unless otherwise exempt, the Contractor, as owner or operator of a facility used in the performance of this contract, shall file by July 1 for the prior calendar year an annual Toxic Chemical Release Inventory Form (Form R) as described in sections 313(a) and (g) of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11023(a) and (g)), and section 6607 of the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13106). The Contractor shall file, for each facility subject to the Form R filing and reporting requirements, the annual Form R throughout the life of the contract.

(b) A Contractor owned or operated facility use in the performance of this contract is exempt from the requirement to file an annual Form R if--

(1) The facility does not manufacture, process or otherwise use any toxic chemicals listed under section 313(c) of EPCRA, 42 U.S.C. 11023(c);

(2) The facility does not have 10 or more full-time employees as specified in section 313(b)(1)(A) of EPCRA, 42 U.S.C. 11023(b)(1)(A);

(3) The facility does not meet the reporting thresholds of toxic chemicals established under section 313(f) of EPCRA, 42 U.S.C. 11023(f) (including the alternate thresholds at 40 CFR 372.27, provided an appropriate certification form has been filed with EPA);

(4) The facility does not fall within Standard Industrial Classification Code (SIC) major groups 20 through 39 or their corresponding North American Industry Classification System (NAICS) sectors 31 through 33; or

(5) The facility is not located within any State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, American Samoa, the United States Virgin Islands, the Northern Mariana Islands, or any other territory or possession over which the United States has jurisdiction.

(c) If the Contractor has certified to an exemption in accordance with one or more of the criteria in paragraph (b) of this clause, and after award of the contract circumstances change so that any one of its owned or operated facilities used in the performance of this contract is no longer exempt-

(1) The Contractor shall notify the Contracting Officer;

and

(2) The Contractor, as owner or operator of a facility used in the performance of this contract is no longer exempt, shall (i) submit a Toxic Chemical Release Inventory Form (Form R) on or before July 1 for the prior calendar year during which the facility becomes eligible; and (ii) continue to file the annual Form R for the life of the contract for such facility.

(d) The Contracting Officer may terminate this contract or take other action as appropriate, if the Contractor fails to comply accurately and fully with the EPCRA and PPA toxic chemical release filing and reporting requirements.

(e) Except for acquisitions of commercial items, as defined in FAR Part 2, the Contractor shall-

(1) For competitive subcontracts expected to exceed \$100,000 (including all options), include a solicitation provision substantially the same as the provision at FAR 52.223-13, Certification of Toxic Chemical Release Reporting; and

(2) Include in any resultant subcontract exceeding \$100,000 (including all options), the substance of this clause, except this paragraph (e).

#### **54. RESERVED**

#### **55. DFARS 252.223-7006 PROHIBITION ON STORAGE AND DISPOSAL OF TOXIC AND HAZARDOUS MATERIALS (APR 1993)**

(a) Definitions. As used in this clause--

(1) "Storage" means a non-transitory, semi-permanent or permanent holding, placement, or leaving of material. It does not include a temporary accumulation of a limited quantity of a material used in or a waste generated or resulting from authorized activities, such as servicing, maintenance, or repair of Department of Defense (DoD) items, equipment, or facilities.

(2) "Toxic or hazardous materials" means:

(i) Materials referred to in section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (42 U.S.C. 9601(14)) and materials designated under section 102 of CERCLA (42 U.S.C. 9602) (40 CFR Part 302);

(ii) Materials that are of an explosive, flammable, or pyrotechnic nature; or

(iii) Materials otherwise identified by the Secretary of Defense as specified in DoD regulations.

(b) In accordance with 10 U.S.C. 2692, the Contractor is prohibited from storing or disposing of non-DoD-owned toxic or hazardous materials on a DoD installation, except to the extent authorized by a statutory exception to 10 U.S.C. 2692 or as authorized by the Secretary of Defense or his designee.

**56. \*FAR 52.225-9 BUY AMERICAN ACT—CONSTRUCTION MATERIALS (MAY 2002) (For Contracts less than \$6.481 million)**

(a) *Definitions.* As used in this clause—

“Component” means an article, material, or supply incorporated directly into a construction material.

“Construction material” means an article, material, or supply brought to the construction site by the Contractor or a subcontractor for incorporation into the building or work. The term also includes an item brought to the site preassembled from articles, materials, or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and audio evacuation systems, that are discrete systems incorporated into a public building or work and that are produced as complete systems, are evaluated as a single and distinct construction material regardless of when or how the individual parts or components of those systems are delivered to the construction site. Materials purchased directly by the Government are supplies, not construction material.

“Cost of components” means—

(1) For components purchased by the Contractor, the acquisition cost, including transportation costs to the place of incorporation into the construction material (whether or not such costs are paid to a domestic firm), and any applicable duty (whether or not a duty-free entry certificate is issued); or

(2) For components manufactured by the Contractor, all costs associated with the manufacture of the component, including transportation costs as described in paragraph (1) of this definition, plus allocable overhead costs, but excluding profit. Cost of components does not include any costs associated with the manufacture of the end product.

“Domestic construction material” means—

(1) An unmanufactured construction material mined or produced in the United States; or

(2) A construction material manufactured in the United States, if the cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind for which nonavailability determinations have been made are treated as domestic.

“Foreign construction material” means a construction material other than a domestic construction material.

“United States” means the 50 States and the District of Columbia, U.S. territories and possessions, Puerto Rico, the Northern Mariana Islands, and any other place subject to U.S. jurisdiction, but does not include leased bases.

(b) *Domestic preference.* (1) This clause implements the Buy American Act (41 U.S.C. 10a - 10d) by providing a preference for domestic construction material. The Contractor shall use only domestic construction material in performing this contract, except as provided in paragraphs (b)(2) and (b)(3) of this clause.

(2) This requirement does not apply to the construction material or components listed by the Government as follows:

*[Contracting Officer to list applicable excepted materials or indicate “none”]*

(3) The Contracting Officer may add other foreign construction material to the list in paragraph (b)(2) of this clause if the Government determines that—

(i) The cost of domestic construction material would be unreasonable. The cost of a particular domestic construction material subject to the requirements of the Buy American Act is unreasonable when the cost of such material exceeds the cost of foreign material by more than 6 percent;

(ii) The application of the restriction of the Buy American Act to a particular construction material would be impracticable or inconsistent with the public interest; or

(iii) The construction material is not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities of a satisfactory quality.

(c) *Request for determination of inapplicability of the Buy American Act.* (1)(i) Any Contractor request to

use foreign construction material in accordance with paragraph (b)(3) of this clause shall include adequate information for Government evaluation of the request, including—

- (A) A description of the foreign and domestic construction materials;
- (B) Unit of measure;
- (C) Quantity;
- (D) Price;
- (E) Time of delivery or availability;
- (F) Location of the construction project;
- (G) Name and address of the proposed supplier; and
- (H) A detailed justification of the reason for use of foreign construction

materials cited in accordance with paragraph (b)(3) of this clause.

(ii) A request based on unreasonable cost shall include a reasonable survey of the market and a completed price comparison table in the format in paragraph (d) of this clause.

(iii) The price of construction material shall include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate may be issued).

(iv) Any Contractor request for a determination submitted after contract award shall explain why the Contractor could not reasonably foresee the need for such determination and could not have requested the determination before contract award. If the Contractor does not submit a satisfactory explanation, the Contracting Officer need not make a determination.

(2) If the Government determines after contract award that an exception to the Buy American Act applies and the Contracting Officer and the Contractor negotiate adequate consideration, the Contracting Officer will modify the contract to allow use of the foreign construction material. However, when the basis for the exception is the unreasonable price of a domestic construction material, adequate consideration is not less than the differential established in paragraph (b)(3)(i) of this clause.

(3) Unless the Government determines that an exception to the Buy American Act applies, use of foreign construction material is noncompliant with the Buy American Act.

(d) *Data*. To permit evaluation of requests under paragraph (c) of this clause based on unreasonable cost, the Contractor shall include the following information and any applicable supporting data based on the survey of suppliers:

FOREIGN AND DOMESTIC CONSTRUCTION MATERIALS PRICE COMPARISON			
Construction Material Description	Unit of Measure	Quantity	Price (Dollars)*
Item 1:			
Foreign construction material			
Domestic construction material	_____	_____	_____
Item 2:			
Foreign construction material			
Domestic construction material			

[List name, address, telephone number, and contact for suppliers surveyed. Attach copy of response; if oral, attach summary.]  
[Include other applicable supporting information.]

[\* Include all delivery costs to the construction site and any applicable duty (whether or not a duty-free entry certificate is issued).]

**57. \*FAR 52.225-10 NOTICE OF BUY AMERICAN ACT REQUIREMENT—CONSTRUCTION MATERIALS (MAY 2002) (Applicable with FAR 52.225-9)**

(a) *Definitions*. “Construction material,” “domestic construction material,” and “foreign construction material,” as used in this provision, are defined in the clause of this solicitation entitled “Buy American Act—Construction Materials” (Federal Acquisition Regulation (FAR) clause 52.225-9).

(b) *Requests for determinations of inapplicability*. An offeror requesting a determination regarding the

inapplicability of the Buy American Act should submit the request to the Contracting Officer in time to allow a determination before submission of offers. The offeror shall include the information and applicable supporting data required by paragraphs (c) and (d) of the clause at FAR 52.225-9 in the request. If an offeror has not requested a determination regarding the inapplicability of the Buy American Act before submitting its offer, or has not received a response to a previous request, the offeror shall include the information and supporting data in the offer.

(c) *Evaluation of offers.* (1) The Government will evaluate an offer requesting exception to the requirements of the Buy American Act, based on claimed unreasonable cost of domestic construction material, by adding to the offered price the appropriate percentage of the cost of such foreign construction material, as specified in paragraph (b)(3)(i) of the clause at FAR 52.225-9.

(2) If evaluation results in a tie between an offeror that requested the substitution of foreign construction material based on unreasonable cost and an offeror that did not request an exception, the Contracting Officer will award to the offeror that did not request an exception based on unreasonable cost.

(d) *Alternate offers.* (1) When an offer includes foreign construction material not listed by the Government in this solicitation in paragraph (b)(2) of the clause at FAR 52.225-9, the offeror also may submit an alternate offer based on use of equivalent domestic construction material.

(2) If an alternate offer is submitted, the offeror shall submit a separate Standard Form 1442 for the alternate offer, and a separate price comparison table prepared in accordance with paragraphs (c) and (d) of the clause at FAR 52.225-9 for the offer that is based on the use of any foreign construction material for which the Government has not yet determined an exception applies.

(3) If the Government determines that a particular exception requested in accordance with paragraph (c) of the clause at FAR 52.225-9 does not apply, the Government will evaluate only those offers based on use of the equivalent domestic construction material, and the offeror shall be required to furnish such domestic construction material. An offer based on use of the foreign construction material for which an exception was requested—

- (i) Will be rejected as nonresponsive if this acquisition is conducted by sealed bidding; or
- (ii) May be accepted if revised during negotiations.

(End of provision)

**58. \*FAR 52.225-11 BUY AMERICAN ACT—CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS (JULY 2002) [For Contracts more than \$6,481,000] ALTERNATE I (MAY 2002) [For Contracts between \$6.481 and 7.304733 Million]**

(a) *Definitions.* As used in this clause—

“Component” means an article, material, or supply incorporated directly into a construction material.

“Construction material” means an article, material, or supply brought to the construction site by the Contractor or subcontractor for incorporation into the building or work. The term also includes an item brought to the site preassembled from articles, materials, or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and audio evacuation systems, that are discrete systems incorporated into a public building or work and that are produced as complete systems, are evaluated as a single and distinct construction material regardless of when or how the individual parts or components of those systems are delivered to the construction site. Materials purchased directly by the Government are supplies, not construction material.

“Cost of components” means—

(1) For components purchased by the Contractor, the acquisition cost, including transportation costs to the place of incorporation into the construction material (whether or not such costs are paid to a domestic firm), and any applicable duty (whether or not a duty-free entry certificate is issued); or

(2) For components manufactured by the Contractor, all costs associated with the manufacture of the component, including transportation costs as described in paragraph (1) of this definition, plus allocable overhead costs, but excluding profit. Cost of components does not include any costs associated with the manufacture of the end product.

“Designated country” means any of the following countries:

Aruba	Kiribati
Austria	Korea, Republic of

Bangladesh	Lesotho
Belgium	Liechtenstein
Benin	Luxembourg
Bhutan	Malawi
Botswana	Maldives
Burkina Faso	Mali
Burundi	Mozambique
Canada	Nepal
Cape Verde	Netherlands
Central African Republic	Niger
Chad	Norway
Comoros	Portugal
Denmark	Rwanda
Djibouti	Sao Tome and Principe
Equatorial Guinea	Sierra Leone
Finland	Singapore
France	Somalia
Gambia	Spain
Germany	Sweden
Greece	Switzerland
Guinea	Tanzania U.R.
Guinea-Bissau	Togo
Haiti	Tuvalu
Hong Kong	Uganda
Iceland	United Kingdom
Ireland	Vanuatu
Israel	Western Samoa
Italy	Yemen
Japan	

“Designated country construction material” means a construction material that—

- (1) Is wholly the growth, product, or manufacture of a designated country; or
- (2) In the case of a construction material that consists in whole or in part of materials from another country, has been substantially transformed in a designated country into a new and different construction material distinct from the materials from which it was transformed.

“Domestic construction material” means—

- (1) An unmanufactured construction material mined or produced in the United States; or
- (2) A construction material manufactured in the United States, if the cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind for which nonavailability determinations have been made are treated as domestic.

“Foreign construction material” means a construction material other than a domestic construction material.

“North American Free Trade Agreement country” means Canada or Mexico.

“North American Free Trade Agreement country construction material” means a construction material that—

- (1) Is wholly the growth, product, or manufacture of a North American Free Trade Agreement (NAFTA) country; or
- (2) In the case of a construction material that consists in whole or in part of materials from another country, has been substantially transformed in a NAFTA country into a new and different construction material distinct from the materials from which it was transformed.

“United States” means the 50 States and the District of Columbia, U.S. territories and possessions, Puerto Rico, the Northern Mariana Islands, and any other place subject to U.S. jurisdiction, but does not include leased bases.

(b) *Construction materials.* (1) This clause implements the Buy American Act (41 U.S.C. 10a - 10d) by

providing a preference for domestic construction material. In addition, the Contracting Officer has determined that the Trade Agreements Act and the North American Free Trade Agreement (NAFTA) apply to this acquisition. Therefore, the Buy American Act restrictions are waived for designated country and NAFTA country construction materials.

(2) The Contractor shall use only domestic, designated country, or NAFTA country construction material in performing this contract, except as provided in paragraphs (b)(3) and (b)(4) of this clause.

(3) The requirement in paragraph (b)(2) of this clause does not apply to the construction materials or components listed by the Government as follows:

[Contracting Officer to list applicable excepted materials or indicate "none"]

(4) The Contracting Officer may add other foreign construction material to the list in paragraph (b)(3) of this clause if the Government determines that—

(i) The cost of domestic construction material would be unreasonable. The cost of a particular domestic construction material subject to the restrictions of the Buy American Act is unreasonable when the cost of such material exceeds the cost of foreign material by more than 6 percent;

(ii) The application of the restriction of the Buy American Act to a particular construction material would be impracticable or inconsistent with the public interest; or

(iii) The construction material is not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities of a satisfactory quality.

(c) *Request for determination of inapplicability of the Buy American Act.* (1)(i) Any Contractor request to use foreign construction material in accordance with paragraph (b)(4) of this clause shall include adequate information for Government evaluation of the request, including—

(A) A description of the foreign and domestic construction materials;

(B) Unit of measure;

(C) Quantity;

(D) Price;

(E) Time of delivery or availability;

(F) Location of the construction project;

(G) Name and address of the proposed supplier; and

(H) A detailed justification of the reason for use of foreign construction

materials cited in accordance with paragraph (b)(3) of this clause.

(ii) A request based on unreasonable cost shall include a reasonable survey of the market and a completed price comparison table in the format in paragraph (d) of this clause.

(iii) The price of construction material shall include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate may be issued).

(iv) Any Contractor request for a determination submitted after contract award shall explain why the Contractor could not reasonably foresee the need for such determination and could not have requested the determination before contract award. If the Contractor does not submit a satisfactory explanation, the Contracting Officer need not make a determination.

(2) If the Government determines after contract award that an exception to the Buy American Act applies and the Contracting Officer and the Contractor negotiate adequate consideration, the Contracting Officer will modify the contract to allow use of the foreign construction material. However, when the basis for the exception is the unreasonable price of a domestic construction material, adequate consideration is not less than the differential established in paragraph (b)(4)(i) of this clause.

(3) Unless the Government determines that an exception to the Buy American Act applies, use of foreign construction material is noncompliant with the Buy American Act.

(d) *Data.* To permit evaluation of requests under paragraph (c) of this clause based on unreasonable cost, the Contractor shall include the following information and any applicable supporting data based on the survey of suppliers:

FOREIGN AND DOMESTIC CONSTRUCTION MATERIALS PRICE COMPARISON			
Construction Material Description	Unit of Measure	Quantity	Price (Dollars)*
Item 1:			
Foreign construction material			
Domestic construction material	_____	_____	_____
Item 2:			
Foreign construction material			
Domestic construction material			

[List name, address, telephone number, and contact for suppliers surveyed. Attach copy of response; if oral, attach summary.]  
[Include other applicable supporting information.]

[\* Include all delivery costs to the construction site and any applicable duty (whether or not a duty-free entry certificate is issued).]

(End of clause)

*Alternate I (May 2002).* As prescribed in 25.1102(c)(3), delete the definitions of “North American Free Trade Agreement country” and “North American Free Trade Agreement country construction material” from the definitions in paragraph (a) of the basic clause and substitute the following paragraphs (b)(1) and (b)(2) for paragraphs (b)(1) and (b)(2) of the basic clause:

(b) *Construction materials.* (1) This clause implements the Buy American Act (41 U.S.C. 10a - 10d) by providing a preference for domestic construction material. In addition, the Contracting Officer has determined that the Trade Agreements Act applies to this acquisition. Therefore, the Buy American Act restrictions are waived for designated country construction materials.

(2) The Contractor shall use only domestic or designated country construction material in performing this contract, except as provided in paragraphs (b)(3) and (b)(4) of this clause.

**59. \*FAR 52.225-12 NOTICE OF BUY AMERICAN ACT REQUIREMENT—CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS (MAY 2002) [Applicable with FAR 52.225-11] ALTERNATE II (MAY 2002) [For Contracts Between 6.481 and 7.344733 Million]**

(a) *Definitions.* “Construction material,” “designated country construction material,” “domestic construction material,” “foreign construction material,” and “NAFTA country construction material,” as used in this provision, are defined in the clause of this solicitation entitled “Buy American Act—Construction Materials under Trade Agreements” (Federal Acquisition Regulation (FAR) clause 52.225-11).

(b) *Requests for determination of inapplicability.* An offeror requesting a determination regarding the inapplicability of the Buy American Act should submit the request to the Contracting Officer in time to allow a determination before submission of offers. The offeror shall include the information and applicable supporting data required by paragraphs (c) and (d) of FAR clause 52.225-11 in the request. If an offeror has not requested a determination regarding the inapplicability of the Buy American Act before submitting its offer, or has not received a response to a previous request, the offeror shall include the information and supporting data in the offer.

(c) *Evaluation of offers.* (1) The Government will evaluate an offer requesting exception to the requirements of the Buy American Act, based on claimed unreasonable cost of domestic construction materials, by adding to the offered price the appropriate percentage of the cost of such foreign construction material, as specified in paragraph (b)(4)(i) of FAR clause 52.225-11.

(2) If evaluation results in a tie between an offeror that requested the substitution of foreign construction material based on unreasonable cost and an offeror that did not request an exception, the Contracting Officer will award to the offeror that did not request an exception based on unreasonable cost.

(d) *Alternate offers.* (1) When an offer includes foreign construction material, other than designated country or NAFTA country construction material, that is not listed by the Government in this solicitation in paragraph (b)(3) of FAR clause 52.225-11, the offeror also may submit an alternate offer based on use of equivalent domestic,

designated country, or NAFTA country construction material.

(2) If an alternate offer is submitted, the offeror shall submit a separate Standard Form 1442 for the alternate offer, and a separate price comparison table prepared in accordance with paragraphs (c) and (d) of FAR clause 52.225-11 for the offer that is based on the use of any foreign construction material for which the Government has not yet determined an exception applies.

(3) If the Government determines that a particular exception requested in accordance with paragraph (c) of FAR clause 52.225-11 does not apply, the Government will evaluate only those offers based on use of the equivalent domestic, designated country, or NAFTA country construction material, and the offeror shall be required to furnish such domestic, designated country, or NAFTA country construction material. An offer based on use of the foreign construction material for which an exception was requested—

- (i) Will be rejected as nonresponsive if this acquisition is conducted by sealed bidding; or
- (ii) May be accepted if revised during negotiations.

(End of provision)

**ALTERNATE II (MAY 2002) [For Contracts between 6.481 and 7.304733 Million]**

As prescribed in 25.1102(d)(3), substitute the following paragraphs (a) and (d) for paragraphs (a) and (d) of the basic provision:

(a) *Definitions.* “Construction material,” “designated country construction material,” “domestic construction material,” and “foreign construction material,” as used in this provision, are defined in the clause of this solicitation entitled “Buy American Act—Construction Materials under Trade Agreements” (Federal Acquisition Regulation (FAR) clause 52.225-11).

(d) *Alternate offers.* (1) When an offer includes foreign construction material, other than designated country construction material, that is not listed by the Government in this solicitation in paragraph (b)(3) of FAR clause 52.225-11, the offeror also may submit an alternate offer based on use of equivalent domestic or designated country construction material.

(2) If an alternate offer is submitted, the offeror shall submit a separate Standard Form 1442 for the alternate offer, and a separate price comparison table prepared in accordance with paragraphs (c) and (d) of FAR clause 52.225-11 for the offer that is based on the use of any foreign construction material for which the Government has not yet determined an exception applies.

(3) If the Government determines that a particular exception requested in accordance with paragraph (c) of FAR clause 52.225-11 does not apply, the Government will evaluate only those offers based on use of the equivalent domestic or designated country construction material, and the offeror shall be required to furnish such domestic or designated country construction material. An offer based on use of the foreign construction material for which an exception was requested—

- (i) Will be rejected as nonresponsive if this acquisition is conducted by sealed bidding; or
- (ii) May be accepted if revised during negotiations.

**60. \*FAR 52.225-13 RESTRICTIONS ON CERTAIN FOREIGN PURCHASES (JULY 2000)**

(a) The Contractor shall not acquire, for use in the performance of this contract, any supplies or services originating from sources within, or that were located in or transported from or through, countries whose products are banned from importation into the United States under regulations of the Office of Foreign Assets Control, Department of the Treasury. Those countries are Cuba, Iran, Iraq, Libya, North Korea, Sudan, the territory of Afghanistan controlled by the Taliban, and Serbia (excluding the territory of Kosovo).

(b) The Contractor shall not acquire for use in the performance of this contract any supplies or services from entities controlled by the government of Iraq.

(c) The Contractor shall insert this clause, including this paragraph (c), in all subcontracts.

(End of clause)

**61. \*FAR 52.226-1 UTILIZATION OF INDIAN ORGANIZATIONS AND INDIAN-OWNED ECONOMIC ENTERPRISES (JUNE 2000)**

(a) Definitions. As used in this clause:

“Indian” means any person who is a member of any Indian tribe, band, group, pueblo, or community that is recognized by the Federal Government as eligible for services from the Bureau of Indian Affairs (BIA) in accordance with 25 U.S.C. 1452(c) and any “Native” as defined in the Alaska Native Claims Settlement Act (43 U.S.C. 1601).

“Indian organization” means the governing body of any Indian tribe or entity established or recognized by the governing body of an Indian tribe for the purposes of 25 U.S.C., chapter 17.

“Indian-owned economic enterprise” means any Indian-owned (as determined by the Secretary of the Interior) commercial, industrial, or business activity established or organized for the purpose of profit, provided that Indian ownership constitutes not less than 51 percent of the enterprise.

“Indian tribe” means any Indian tribe, band, group, pueblo, or community, including native villages and native groups (including corporations organized by Kenai, Juneau, Sitka, and Kodiak) as defined in the Alaska Native Claims Settlement Act, that is recognized by the Federal Government as eligible for services from BIA in accordance with 25 U.S.C. 1452(c).

“Interested party” means a prime contractor or an actual or prospective offeror whose direct economic interest would be affected by the award of a subcontract or by the failure to award a subcontract.

(b) The Contractor shall use its best efforts to give Indian organizations and Indian-owned economic enterprises (25 U.S.C. 1544) the maximum practicable opportunity to participate in the subcontracts it awards to the fullest extent consistent with efficient performance of its contract.

(1) The Contracting Officer and the Contractor, acting in good faith, may rely on the representation of an Indian organization or Indian-owned economic enterprise as to its eligibility, unless an interested party challenges its status or the Contracting Officer has independent reason to question that status. In the event of a challenge to the representation of a subcontractor, the Contracting Officer will refer the matter to the—

U.S. Department of the Interior  
Bureau of Indian Affairs (BIA)  
Attn: Chief, Division of Contracting and  
Grants Administration  
1849 C Street, NW,  
MS-2626-MIB  
Washington, DC 20240-4000.

The BIA will determine the eligibility and notify the Contracting Officer. No incentive payment will be made within 50 working days of subcontract award or while a challenge is pending. If a subcontractor is determined to be an ineligible participant, no incentive payment will be made under the Indian Incentive Program.

(2) The Contractor may request an adjustment under the Indian Incentive Program to the following:

- (i) The estimated cost of a cost-type contract.
- (ii) The target cost of a cost-plus-incentive-fee prime contract.
- (iii) The target cost and ceiling price of a fixed-price incentive prime contract.
- (iv) The price of a firm-fixed-price prime contract.

(3) The amount of the adjustment to the prime contract is 5 percent of the estimated cost, target cost, or firm-fixed-price included in the subcontract initially awarded to the Indian organization or Indian-owned economic enterprise.

(4) The Contractor has the burden of proving the amount claimed and must assert its request for an adjustment prior to completion of contract performance.

(c) The Contracting Officer, subject to the terms and conditions of the contract and the availability of funds, will authorize an incentive payment of 5 percent of the amount paid to the subcontractor. The Contracting Officer will seek funding in accordance with agency procedures.

(End of Clause)

**62. \*FAR 52.227-1 AUTHORIZATION AND CONSENT (JUL 1995)**

(a) The Government authorizes and consents to all use and manufacture, in performing this contract or any subcontract at any tier, of any invention described in and covered by a United States patent

(1) embodied in the structure or composition of any article the delivery of which is accepted by the Government under this contract or

(2) used in machinery, tools, or methods whose use necessarily results from compliance by the Contractor or a subcontractor with

(i) specifications or written provisions forming a part of this contract or

(ii) specific written instructions given by the Contracting Officer directing the manner of performance. The entire liability to the Government for infringement of a patent of the United States shall be determined solely by the provisions of the indemnity clause, if any, included in this contract or any subcontract hereunder (including any lower-tier subcontract), and the Government assumes liability for all other infringement to the extent of the authorization and consent hereinabove granted.

(b) The Contractor agrees to include, and require inclusion of, this clause, suitably modified to identify the parties, in all subcontracts at any tier for supplies or services (including construction, architect-engineer services, and materials, supplies, models, samples, and design or testing services expected to exceed the simplified acquisition threshold) however, omission of this clause from any subcontract, including those at or below the simplified acquisition threshold, does not affect this authorization and consent.

**63. \*FAR 52.227-2 NOTICE AND ASSISTANCE REGARDING PATENT AND COPYRIGHT INFRINGEMENT (AUG 1996)**

(a) The Contractor shall report to the Contracting Officer, promptly and in reasonable written detail, each notice or claim of patent or copy-right infringement based on the performance of this contract of which the Contractor has knowledge.

(b) In the event of any claim or suit against the Government on account of any alleged patent or copyright infringement arising out of the performance of this contract or out of the use of any supplies furnished or work or services performed under this contract, the Contractor shall furnish to the Government, when requested by the Contracting Officer, all evidence and information in possession of the Contractor pertaining to such suit or claim. Such evidence and information shall be furnished at the expense of the Government except where the Contractor has agreed to indemnify the Government.

(c) The Contractor agrees to include, and require inclusion of, this clause in all subcontracts at any tier for supplies or services (including construction and architect-engineer subcontracts and those for material, supplies, models, samples, or design or testing services) expected to exceed the simplified acquisition threshold at FAR 2.101.

**64. \*FAR 52.227-4 PATENT INDEMNITY--CONSTRUCTION CONTRACTS (APR 1984)**

Except as otherwise provided, the Contractor agrees to indemnify the Government and its officers, agents, and employees against liability, including costs and expenses, for infringement upon any United States patent (except a patent issued upon an application that is now or may hereafter be withheld from issue pursuant to a Secrecy Order under 35 U.S.C. 181) arising out of performing this contract or out of the use or disposal by or for the account of the Government of supplies furnished or work performed under this contract.

**65. DFARS 252.227-7033**

**RIGHTS IN SHOP DRAWINGS (APR 1966)**

(a) Shop drawings for construction means drawings, submitted to the Government by the Construction Contractor, subcontractor or any lower-tier subcontractor pursuant to a construction contract, showing in detail

(i) the proposed fabrication and assembly of structural elements and (ii) the installation (i.e., form, fit, and attachment details) of materials or equipment. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

(b) This clause, including this paragraph (b), shall be included in all subcontracts hereunder at any tier.

**66. FAR 52.228-1**

**BID GUARANTEE (SEP 1996) [NOTE: Not required for projects less than**

**\$100,000]**

(a) Failure to furnish a bid guarantee in the proper form and amount, by the time set for opening of bids, may be cause for rejection of bids.

(b) The bidder shall furnish a bid guarantee in the form of a firm commitment, e.g., bid bond supported by good and sufficient surety or sureties acceptable to the Government, postal money order, certified check, cashier's check, irrevocable letter of credit, or, under Treasury Department regulations, certain bonds or notes of the United States. The Contracting Officer will return bid guarantees, other than bid bonds, (1) to unsuccessful bidders as soon as practicable after the opening of bids; and (2) to the successful bidder upon execution of contractual documents and bonds (including any necessary coinsurance or reinsurance agreements), as required by the bid as accepted.

(c) The amount of the bid guarantee shall be twenty (20%) of the bid price or Three Million Dollars (\$3,000,000), whichever is less.

(d) If the successful bidder, upon acceptance of its bid by the Government within the period specified for acceptance, fails to execute all contractual documents or furnish executed bond(s) within 10 days after receipt of the forms by the bidder, the Contracting Officer may terminate the contract for default.

(e) In the event the contract is terminated for default, the bidder is liable for any cost of acquiring the work that exceeds the amount of its bid and the bid guarantee is available to offset the difference.

**67. \*FAR 52.228-2**

**ADDITIONAL BOND SECURITY (OCT 1997)**

The Contractor shall promptly furnish additional security required to protect the Government and persons supplying labor or materials under this contract if--

(a) Any surety upon any bond, or issuing financial institution for other security, furnished with this contract becomes unacceptable to the Government;

(b) Any surety fails to furnish reports on its financial condition as required by the Government;

(c) The contract price is increased so that the penal sum of any bond becomes inadequate in the opinion of the Contracting Officer; or

(d) An irrevocable letter of credit (ILC) used as security will expire before the end of the period of required security. If the Contractor does not furnish an acceptable extension or replacement ILC, or other acceptable substitute, at least 30 days before an ILC's scheduled expiration, the Contracting Officer has the right to immediately draw on the ILC.

**68. \*FAR 52.228-5**

**INSURANCE--WORK ON A GOVERNMENT INSTALLATION (JAN 1997) [For**

**Contracts Exceeding \$100,000**

(a) The Contractor shall, at its own expense, provide and maintain during the entire performance of this contract, at least the kinds and minimum amounts of insurance required in the Schedule or elsewhere in the contract.

(b) Before commencing work under this contract, the Contractor shall notify the Contracting Officer in writing that the required insurance has been obtained. The policies evidencing required insurance shall contain an endorsement to the effect that any cancellation or any material change adversely affecting the Government's interest shall not be effective

(1) for such period as the laws of the State in which this contract is to be performed prescribe, or

(2) until 30 days after the insurer or the Contractor gives written notice to the Contracting Officer, whichever period is longer.

(c) The Contractor shall insert the substance of this clause, including this paragraph (c), in subcontracts under this contract that require work on a Government installation and shall require subcontractors to provide and maintain the insurance required in the Schedule or elsewhere in the contract. The Contractor shall maintain a copy of all subcontractors' proofs of required insurance, and shall make copies available to the Contracting Officer upon request.

**69. \*FAR 52.228-11 PLEDGES OF ASSETS (FEB 1992)**

(a) Offerors shall obtain from each person acting as an individual surety on a bid guarantee, a performance bond, or a payment bond--

- (1) Pledge of assets; and
- (2) Standard Form 28, Affidavit of Individual Surety.

(b) Pledges of assets from each person acting as an individual surety shall be in the form of--

(1) Evidence of an escrow account containing cash, certificates of deposit, commercial or Government securities, or other assets described in FAR 28.203-2 (except see 28.203-2(b)(2) with respect to Government securities held in book entry form) and/or;

(2) A recorded lien on real estate. The offeror will be required to provide--

(i) Evidence of title in the form of a certificate of title prepared by a title insurance company approved by the United States Department of Justice. This title evidence must show fee simple title vested in the surety along with any concurrent owners; whether any real estate taxes are due and payable; and any recorded encumbrances against the property, including the lien filed in favor of the Government as required by FAR 28.203-3(d);

(ii) Evidence of the amount due under any encumbrance shown in the evidence of title;

(iii) A copy of the current real estate tax assessment of the property or a current appraisal dated no earlier than 6 months prior to the date of the bond, prepared by a professional appraiser who certifies that the appraisal has been conducted in accordance with the generally accepted appraisal standards as reflected in the Uniform Standards of Professional Appraisal Practice, as promulgated by the Appraisal Foundation.

**70. \*FAR 52.228-12 PROSPECTIVE SUBCONTRACTOR REQUESTS FOR BONDS (OCT 1995)**

In accordance with Section 806(a)(3) of Public Law 102-190, as amended by Sections 2091 and 8105 of Pub. L. 103-355, upon the request of a prospective subcontractor or supplier offering to furnish labor or material for the performance of this contract for which a payment bond has been furnished to the Government pursuant to the Miller Act, the Contractor shall promptly provide a copy of such payment bond to the requestor.

**71. FAR 52.228-13 ALTERNATIVE PAYMENT PROTECTIONS (JULY 2000) [Applicable only for projects or delivery orders less than \$100,000]**

- (a) The Contractor shall submit one of the following payment protections:
  - (1) A payment bond.
  - (2) An irrevocable letter of credit from a federally insured financial institution.
- (b) The amount of the payment protection shall be 100 percent of the contract price.
- (c) The submission of the payment protection is required within 10 days of contract award.
- (d) The payment protection shall provide protection for the full contract performance period plus a one-year period.
- (e) Except for escrow agreements and payment bonds, which provide their own protection procedures, the Contracting Officer is authorized to access funds under the payment protection when it has been alleged in writing by a supplier of labor or material that a nonpayment has occurred, and to withhold funds pending resolution by administrative or judicial proceedings or mutual agreement of the parties.
- (f) When a tripartite escrow agreement is used, the Contractor shall utilize only suppliers of labor and material that signed the escrow agreement.

**72. FAR 52.228-14 IRREVOCABLE LETTER OF CREDIT (DEC 1999)**

- (a) "Irrevocable letter of credit" (ILC), as used in this clause, means a written commitment by a federally insured financial institution to pay all or part of a stated amount of money, until the expiration date of the letter, upon presentation by the Government (the beneficiary) of a written demand therefor. Neither the financial institution nor the offeror/Contractor can revoke or condition the letter of credit.
- (b) If the offeror intends to use an ILC in lieu of a bid bond, or to secure other types of bonds such as performance and payment bonds, the letter of credit and letter of confirmation formats in paragraphs (e) and (f) of this clause shall be used.
- (c) The letter of credit shall be irrevocable, shall require presentation of no document other than a written demand and the ILC (including confirming letter, if any), shall be issued/confirmed by an acceptable federally insured financial institution as provided in paragraph (d) of this clause, and--
  - (1) If used as a bid guarantee, the ILC shall expire no earlier than 60 days after the close of the bid acceptance period;
  - (2) If used as an alternative to corporate or individual sureties as security for a performance or payment bond, the offeror/Contractor may submit an ILC to cover the entire period of performance or may submit an ILC with an initial expiration date estimated to cover the entire period for which financial security is required or may submit an ILC with an initial expiration that is a minimum period of one year from the date of issuance. The ILC shall provide that, unless the issuer provides the beneficiary written notice of non-renewal of least 60 days in advance of the current expiration date, the ILC is automatically extended without amendment for one year from the expiration date, or any future expiration date, until the period of required coverage is completed and the Contracting Officer provides the financial institution with a written statement waiving the right to payment. The period of required coverage shall be:
    - (i) For contracts subject to the Miller Act, the later of--
      - (A) One year following the expected date of final payment;
      - (B) For performance bonds only, until completion of any warranty period; or
      - (C) For payment bonds only, until resolution of all claims filed against the payment bond during the one-year period following final payment.
    - (ii) For contracts not subject to the Miller Act, the later of--
      - (A) 90 days following final payment; or
      - (B) For performance bonds only, until completion of any warranty period.
- (d) Only federally insured financial institution rated investment grade or higher shall issue or confirm the ILC. The offeror/Contractor shall provide the Contracting Officer a credit rating that indicates the financial institution has the required rating(s) as of the date of issuance of the ILC. Unless the financial institution issuing the

ILC had letter of credit business of at least \$25 million in the past year, ILCs over \$5 million must be confirmed by another acceptable financial institution that had letter of credit business of at least \$25 million in the past year.

(e) The following format shall be used by the issuing financial institution to create an ILC:

-----  
[Issuing Financial Institution's Letterhead or Name and Address]

Issue Date-----

Irrevocable Letter of Credit No.-----

Account party's name-----

Account party's address-----

For Solicitation No.-----

(For reference only)

TO: [U.S. Government agency]

[U.S. Government agency's address]

1. We hereby establish this irrevocable and transferable Letter of Credit in your favor for one or more drawings up to United States \$ \_\_\_\_\_. This Letter of Credit is payable at [issuing financial institution's and, if any, confirming financial institution's] office at [issuing financial institution's address and, if any, confirming financial institution's address] and expires with our close of business on \_\_\_\_\_, or any automatically extended expiration date.

2. We hereby undertake to honor your or transferee's sight draft(s) drawn on issuing or, if any, the confirming financial institution, for all or any part of this credit if presented with this Letter of Credit and confirmation, if any, at the office specified in paragraph 1 of this Letter of Credit on or before the expiration date or any automatically extended expiration date.

3. [This paragraph is omitted if used as a bid guarantee, and subsequent paragraphs are renumbered.] It is a condition of this Letter of Credit that it is deemed to be automatically extended without amendment for one year from the expiration date hereof, or any future expiration date, unless at least 60 days prior to any expiration date, we notify you or the transferee by registered mail, or other receipted means of delivery, that we elect not to consider this Letter of Credit renewed for any such additional period. At the time we notify you, we also agree to notify the account party (and confirming financial institution, if any) by the same means of delivery.

4. This Letter of Credit is transferable. Transfers and assignments of proceeds are to be effected without charge to either the beneficiary or the transferee/assignee of proceeds. Such transfer or assignment shall be only at the written direction of the Government (the beneficiary) in a form satisfactory to the issuing financial institution and the confirming financial institution, if any.

5. This Letter of Credit is subject to the Uniform Customs and Practice (UCP) for Documentary Credits, 1993 Revision, International Chamber of Commerce Publication No. 500, and to the extent not inconsistent therewith, to the laws of \_\_\_\_\_ [state of confirming financial institution, if any, otherwise state of issuing financial institution].

6. If this credit expires during an interruption of business of this financial institution as described in Article 17 of the UCP, the financial institution specifically agrees to effect payment if this credit is drawn against within 30 days after the resumption of our business.

Sincerely,

[Issuing financial institution]

(f) The following format shall be used by the financial institution to confirm an ILC:

[Confirming Financial Institution's Letterhead or Name and Address]---

(Date) \_\_\_\_\_

Our Letter of Credit

Advice Number-----

Beneficiary:-----

[U.S. Government agency]

Issuing Financial Institution:-----

Issuing Financial Institution's LC No.:-----

Gentlemen:

1. We hereby confirm the above indicated Letter of Credit, the original of which is attached, issued by \_\_\_\_\_ [name of issuing financial institution] for drawings of up to United States dollars \_\_\_\_\_/U.S. \$ \_\_\_\_\_ and expiring with our close of business on \_\_\_\_\_ [the expiration date], or any automatically extended expiration date.

2. Draft(s) drawn under the Letter of Credit and this Confirmation are payable at our office located at \_\_\_\_\_.

3. We hereby undertake to honor sight draft(s) drawn under and presented with the Letter of Credit and this Confirmation at our offices as specified herein.

4. [This paragraph is omitted if used as a bid guarantee, and subsequent paragraphs are renumbered.] It is a condition of this confirmation that it be deemed automatically extended without amendment for one year from the expiration date hereof, or any automatically extended expiration date, unless:

(a) At least 60 days prior to any such expiration date, we shall notify the Contracting Officer, or the transferee and the issuing financial institution, by registered mail or other receipted means of delivery, that we elect not to consider this confirmation extended for any such additional period; or

(b) The issuing financial institution shall have exercised its right to notify you or the transferee, the account party, and ourselves, of its election not to extend the expiration date of the Letter of Credit.

5. This confirmation is subject to the Uniform Customs and Practice (UCP) for Documentary Credits, 1993 Revision, International Chamber of Commerce Publication No. 500, and to the extent not inconsistent therewith, to the laws of \_\_\_\_\_ [state of confirming financial institution].

6. If this confirmation expires during an interruption of business of this financial institution as described in Article 17 of the UCP, we specifically agree to effect payment if this credit is drawn against within 30 days after the resumption of our business.

Sincerely,

-----  
[Confirming financial institution]

(g) The following format shall be used by the Contracting Officer for a sight draft to draw on the Letter of Credit:  
SIGHT DRAFT

-----  
[City, State]

(Date) \_\_\_\_\_

[Name and address of financial institution]

Pay to the order of-----

[Beneficiary Agency] \_\_\_\_\_

the sum of United States \$ \_\_\_\_\_

This draft is drawn under-----

Irrevocable Letter of Credit No.-----

-----  
[Beneficiary Agency]

By: \_\_\_\_\_

**73. FAR 52.228-15 PERFORMANCE AND PAYMENT BONDS (JULY 2000).**

[This provision is Not Required for projects less than \$100,000. See Clauses "Alternate Payment Protections" and "Inapplicable Provisions and Clauses".]

(a) *Definitions.* As used in this clause—

“Original contract price” means the award price of the contract; or, for requirements contracts, the price payable for the estimated total quantity; or, for indefinite-quantity contracts, the price payable for the specified minimum quantity. Original contract price does not include the price of any options, except those options exercised at the time of contract award.

(b) *Amount of required bonds.* Unless the resulting contract price is \$100,000 or less, the successful offeror shall furnish performance and payment bonds to the Contracting Officer as follows:

(1) *Performance bonds (Standard Form 25).* The penal amount of performance bonds at the time of contract award shall be 100 percent of the original contract price.

(2) *Payment Bonds (Standard Form 25-A).* The penal amount of payment bonds at the time of contract award shall be 100 percent of the original contract price.

(3) *Additional bond protection.* (i) The Government may require additional performance and payment bond protection if the contract price is increased. The increase in protection generally will equal 100 percent of the increase in contract price.

(ii) The Government may secure the additional protection by directing the Contractor to increase the penal amount of the existing bond or to obtain an additional bond.

(c) *Furnishing executed bonds.* The Contractor shall furnish all executed bonds, including any necessary reinsurance agreements, to the Contracting Officer, within the time period specified in the Bid Guarantee provision of the solicitation, or otherwise specified by the Contracting Officer, but in any event, before starting work.

(d) *Surety or other security for bonds.* The bonds shall be in the form of firm commitment, supported by corporate sureties whose names appear on the list contained in Treasury Department Circular 570, individual sureties, or by other acceptable security such as postal money order, certified check, cashier’s check, irrevocable letter of credit, or, in accordance with Treasury Department regulations, certain bonds or notes of the United States. Treasury Circular 570 is published in the Federal Register or may be obtained from the:

U.S. Department of Treasury  
Financial Management Service  
Surety Bond Branch  
401 14th Street, NW, 2nd Floor, West Wing  
Washington, DC 20227.

(e) *Notice of subcontractor waiver of protection (40 U.S.C. 270b(c)).* Any waiver of the right to sue on the payment bond is void unless it is in writing, signed by the person whose right is waived, and executed after such person has first furnished labor or material for use in the performance of the contract.

(End of clause)

**74. FAR 52.229-3 FEDERAL, STATE, AND LOCAL TAXES (APR 2003) [For Contracts Exceeding \$100,000]**

(a) As used in this clause--

"All applicable Federal, State, and local taxes and duties," means all taxes and duties, in effect on the contract date, that the taxing authority is imposing and collecting on the transactions or property covered by this contract.

"After-imposed Federal tax," as used in this clause, means any new or increased Federal excise tax or duty, or tax that was exempted or excluded on the contract date but whose exemption was later revoked or reduced during the contract period, on the transactions or property covered by this contract that the Contractor is

required to pay or bear as the result of legislative, judicial, or administrative action taking effect after the contract date. It does not include social security tax or other employment taxes.

"After-relieved Federal tax," means any amount of Federal excise tax or duty, except social security or other employment taxes, that would otherwise have been payable on the transactions or property covered by this contract, but which the Contractor is not required to pay or bear, or for which the Contractor obtains a refund or drawback, as the result of legislative, judicial, or administrative action taking effect after the contract date.

"Contract date," means the date set for bid opening or, if this is a negotiated contract or a modification, the effective date of this contract or modification.

"Local taxes" includes taxes imposed by a possession or territory of the United States, Puerto Rico, or the Northern Mariana Islands, if the contract is performed wholly or partly in any of those areas.

(b) The contract price includes all applicable Federal, State, and local taxes and duties.

(c) The contract price shall be increased by the amount of any after-imposed Federal tax, provided the Contractor warrants in writing that no amount for such newly imposed Federal excise tax or duty or rate increase was included in the contract price, as a contingency reserve or otherwise.

(d) The contract price shall be decreased by the amount of any after-relieved Federal tax.

(e) The contract price shall be decreased by the amount of any Federal excise tax or duty, except social security or other employment taxes, that the Contractor is required to pay or bear, or does not obtain a refund of, through the Contractor's fault, negligence, or failure to follow instructions of the Contracting Officer.

(f) No adjustment shall be made in the contract price under this clause unless the amount of the adjustment exceeds \$250.

(g) The Contractor shall promptly notify the Contracting Officer of all matters relating to any Federal excise tax or duty that reasonably may be expected to result in either an increase or decrease in the contract price and shall take appropriate action as the Contracting Officer directs.

(h) The Government shall, without liability, furnish evidence appropriate to establish exemption from any Federal, State, or local tax when the Contractor requests such evidence and a reasonable basis exists to sustain the exemption.

## **75. RESERVED**

## **76. DFARS 252.231-7000 SUPPLEMENTAL COST PRINCIPLES (DEC 1991)**

When the allowability of costs under this contract is determined in accordance with part 31 of the Federal Acquisition Regulation (FAR) allowability shall also be determined in accordance with part 231 of the DoD FAR Supplement, in effect on the date of this contract.

## **77. \*FAR 52.232-5 PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS (SEPT 2002)**

(a) Payment of Price. The Government shall pay the Contractor the contract price as provided in this contract.

(b) Progress Payments. The Government shall make progress payments monthly as the work proceeds, or at more frequent intervals as determined by the Contracting Officer, on estimates of work accomplished which meets the standards of quality established under the contract, as approved by the Contracting Officer.

(1) The Contractor's request for progress payments shall include the following substantiation:

(i) An itemization of the amounts requested, related to the various elements of work required by the contract covered by the payment requested.

(ii) A listing of the amount included for work performed by each subcontractor under the contract.

(iii) A listing of the total amount of each subcontract under the contract.

(iv) A listing of the amounts previously paid to each such subcontractor under the contract.

(v) Additional supporting data in a form and detail required by the Contracting Officer.

(2) In the preparation of estimates, the Contracting Officer may authorize material delivered on the site and preparatory work done to be taken into consideration. Material delivered to the Contractor at locations other than the site also may be taken into consideration if--

(i) Consideration is specifically authorized by this contract; and

(ii) The Contractor furnishes satisfactory evidence that it has acquired title to such material and that the material will be used to perform this contract.

(c) Contractor Certification. Along with each request for progress payments, the Contractor shall furnish the following certification, or payment shall not be made: (However, if the Contractor elects to delete paragraph (c)(4) from the certification, the certification is still acceptable.) I hereby certify, to the best of my knowledge and belief, that--

(1) The amounts requested are only for performance in accordance with the specifications, terms, and conditions of the contract;

(2) All payments due to subcontractors and suppliers from previous payments received under the contract have been made, and timely payments will be made from the proceeds of the payment covered by this certification, in accordance with subcontract agreements and the requirements of chapter 39 of Title 31, United States Code;

(3) This request for progress payments does not include any amounts which the prime contractor intends to withhold or retain from a subcontractor or supplier in accordance with the terms and conditions of the subcontract; and

(4) This certification is not to be construed as final acceptance of a subcontractor's performance.

-----  
(Name)

-----  
(Title)

-----  
(Date)

(d) Refund of Unearned Amounts. If the Contractor, after making a certified request for progress payments, discovers that a portion or all of such request constitutes a payment for performance by the Contractor that fails to conform to the specifications, terms, and conditions of this contract (hereinafter referred to as the "unearned amount"), the Contractor shall--

(1) Notify the Contracting Officer of such performance deficiency; and

(2) Be obligated to pay the Government an amount (computed by the Contracting Officer in the manner provided in paragraph (j) of this clause) equal to interest on the unearned amount from the 8th day after the date of receipt of the unearned amount until--

(i) The date the Contractor notifies the Contracting Officer that the performance deficiency has been corrected; or

(ii) The date the Contractor reduces the amount of any subsequent certified request for progress payments by an amount equal to the unearned amount.

(e) Retainage. If the Contracting Officer finds that satisfactory progress was achieved during any period for which a progress payment is to be made, the Contracting Officer shall authorize payment to be made in full. However, if satisfactory progress has not been made, the Contracting Officer may retain a maximum of 10 percent of the amount of the payment until satisfactory progress is achieved. When the work is substantially complete, the Contracting Officer may retain from previously withheld funds and future progress payments that amount the Contracting Officer considers adequate for protection of the Government and shall release to the Contractor all the remaining withheld funds. Also, on completion and acceptance of each separate building, public work, or other division of the contract, for which the price is stated separately in the contract, payment shall be made for the completed work without retention of a percentage.

(f) Title, Liability, and Reservation of Rights. All material and work covered by progress payments made shall, at the time of payment, become the sole property of the Government, but this shall not be construed as--

(1) Relieving the Contractor from the sole responsibility for all material and work upon which payments have been made or the restoration of any damaged work; or

(2) Waiving the right of the Government to require the fulfillment of all of the terms of the contract.

(g) Reimbursement for Bond Premiums. In making these progress payments, the Government shall, upon request, reimburse the Contractor for the amount of premiums paid for performance and payment bonds (including coinsurance and reinsurance agreements, when applicable) after the Contractor has furnished evidence of full payment to the surety. The retainage provisions in paragraph (e) of this clause shall not apply to that portion of progress payments attributable to bond premiums.

(h) Final Payment. The Government shall pay the amount due the Contractor under this contract after--  
(1) Completion and acceptance of all work;  
(2) Presentation of a properly executed voucher; and  
(3) Presentation of release of all claims against the Government arising by virtue of this contract, other than claims, in stated amounts, that the Contractor has specifically excepted from the operation of the release. A release may also be required of the assignee if the Contractor's claim to amounts payable under this contract has been assigned under the Assignment of Claims Act of 1940 (31 U.S.C. 3727 and 41 U.S.C. 15).

(i) Limitation Because of Unfinalized Work. Notwithstanding any provision of this contract, progress payments shall not exceed 80 percent on work accomplished on unfinalized contract actions. A "contract action" is any action resulting in a contract, as defined in FAR Subpart 2.1, including contract modifications for additional supplies or services, but not including contract modifications that are within the scope and under the terms of the contract, such as contract modifications issued pursuant to the Changes clause, or funding and other administrative changes.

(j) Interest Computation on Unearned Amounts. In accordance with 31 U.S.C. 3903(c)(1), the amount payable under subparagraph (d)(2) of this clause shall be--

- (1) Computed at the rate of average bond equivalent rates of 91-day Treasury bills auctioned at the most recent auction of such bills prior to the date the Contractor receives the unearned amount; and
- (2) Deducted from the next available payment to the Contractor.

## **78. RESERVED.**

## **79. \*FAR 52.232-17 INTEREST (JUN 1996)**

(a) Except as otherwise provided in this contract under a Price Reduction for Defective Cost or Pricing Data clause or a Cost Accounting Standards clause, all amounts that become payable by the Contractor to the Government under this contract (net of any applicable tax credit under the Internal Revenue Code (26 U.S.C. 1481)) shall bear simple interest from the date due until paid unless paid within 30 days of becoming due. The interest rate shall be the interest rate established by the Secretary of the Treasury as provided in Section 12 of the Contract Disputes Act of 1978 (Public Law 95-563), which is applicable to the period in which the amount becomes due, as provided in paragraph (b) of this clause, and then at the rate applicable for each six-month period as fixed by the Secretary until the amount is paid.

(b) Amounts shall be due at the earliest of the following dates:

- (1) The date fixed under this contract.
- (2) The date of the first written demand for payment consistent with this contract, including any demand resulting from a default termination.
- (3) The date the Government transmits to the Contractor a proposed supplemental agreement to confirm completed negotiations establishing the amount of debt.
- (4) If this contract provides for revision of prices, the date of written notice to the Contractor stating the amount of refund payable in connection with a pricing proposal or a negotiated pricing agreement not confirmed by contract modification.

(c) The interest charge made under this clause may be reduced under the procedures prescribed in 32.614-2 of the Federal Acquisition Regulation in effect on the date of this contract.

**80. \*FAR 52.232-23 ASSIGNMENT OF CLAIMS (JAN 1986)**

(a) The Contractor, under the Assignment of Claims Act, as amended, 31 U.S.C. 3727, 41 U.S.C. 15 (hereafter referred to as "the Act"), may assign its rights to be paid amounts due or to become due as a result of the performance of this contract to a bank, trust company, or other financing institution, including any Federal lending agency. The assignee under such an assignment may thereafter further assign or reassign its right under the original assignment to any type of financing institution described in the preceding sentence.

(b) Any assignment or reassignment authorized under the Act and this clause shall cover all unpaid amounts payable under this contract, and shall not be made to more than one party, except that an assignment or reassignment may be made to one party as agent or trustee for two or more parties participating in the financing of this contract.

(c) The Contractor shall not furnish or disclose to any assignee under this contract any classified document (including this contract) or information related to work under this contract until the Contracting Officer authorizes such action in writing.

**81. \*FAR 52.232-27 PROMPT PAY FOR CONSTRUCTION CONTRACTS (FEB 2002)**

Notwithstanding any other payment terms in this contract, the Government will make invoice payments under the terms and conditions specified in this clause. The Government considers payment as being made on the day a check is dated or the date of an electronic funds transfer. Definitions of pertinent terms are set forth in sections 2.101, 32.001, and 32.902 of the Federal Acquisition Regulation. All days referred to in this clause are calendar days, unless otherwise specified. (However, see paragraph (a)(3) concerning payments due on Saturdays, Sundays, and legal holidays.)

(a) *Invoice payments*—(1) *Types of invoice payments*. For purposes of this clause, there are several types of invoice payments that may occur under this contract, as follows:

(i) Progress payments, if provided for elsewhere in this contract, based on Contracting Officer approval of the estimated amount and value of work or services performed, including payments for reaching milestones in any project.

(A) The due date for making such payments is 14 days after the designated billing office receives a proper payment request. If the designated billing office fails to annotate the payment request with the actual date of receipt at the time of receipt, the payment due date is the 14th day after the date of the Contractor's payment request, provided the designated billing office receives a proper payment request and there is no disagreement over quantity, quality, or Contractor compliance with contract requirements.

(B) The due date for payment of any amounts retained by the Contracting Officer in accordance with the clause at 52.232-5, Payments Under Fixed-Price Construction Contracts, is as specified in the contract or, if not specified, 30 days after approval by the Contracting Officer for release to the Contractor.

(ii) Final payments based on completion and acceptance of all work and presentation of release of all claims against the Government arising by virtue of the contract, and payments for partial deliveries that have been accepted by the Government (*e.g.*, each separate building, public work, or other division of the contract for which the price is stated separately in the contract).

(A) The due date for making such payments is the later of the following two events:

(1) The 30th day after the designated billing office receives a proper invoice from the Contractor.

(2) The 30th day after Government acceptance of the work or services completed by the Contractor. For a final invoice when the payment amount is subject to contract settlement actions (*e.g.*, release of claims), acceptance is deemed to occur on the effective date of the contract settlement.

(B) If the designated billing office fails to annotate the invoice with the date of actual receipt at the time of receipt, the invoice payment due date is the 30th day after the date of the Contractor's invoice, provided the designated billing office receives a proper invoice and there is no disagreement over quantity,

quality, or Contractor compliance with contract requirements.

(2) *Contractor's invoice.* The Contractor shall prepare and submit invoices to the designated billing office specified in the contract. A proper invoice must include the items listed in paragraphs (a)(2)(i) through (a)(2)(xi) of this clause. If the invoice does not comply with these requirements, the designated billing office must return it within 7 days after receipt, with the reasons why it is not a proper invoice. When computing any interest penalty owed the Contractor, the Government will take into account if the Government notifies the Contractor of an improper invoice in an untimely manner.

(i) Name and address of the Contractor.

(ii) Invoice date and invoice number. (The Contractor should date invoices as close as possible to the date of mailing or transmission.)

(iii) Contract number or other authorization for work or services performed (including order number and contract line item number).

(iv) Description of work or services performed.

(v) Delivery and payment terms (e.g., discount for prompt payment terms).

(vi) Name and address of Contractor official to whom payment is to be sent (must be the same as that in the contract or in a proper notice of assignment).

(vii) Name (where practicable), title, phone number, and mailing address of person to notify in the event of a defective invoice.

(viii) For payments described in paragraph (a)(1)(i) of this clause, substantiation of the amounts requested and certification in accordance with the requirements of the clause at 52.232–5, Payments Under Fixed-Price Construction Contracts.

(ix) Taxpayer Identification Number (TIN). The Contractor shall include its TIN on the invoice only if required elsewhere in this contract.

(x) Electronic funds transfer (EFT) banking information.

(A) The Contractor shall include EFT banking information on the invoice only if required elsewhere in this contract.

(B) If EFT banking information is not required to be on the invoice, in order for the invoice to be a proper invoice, the Contractor shall have submitted correct EFT banking information in accordance with the applicable solicitation provision (e.g., 52.232–38, Submission of Electronic Funds Transfer Information with Offer), contract clause (e.g., 52.232–33, Payment by Electronic Funds Transfer—Central Contractor Registration, or 52.232–34, Payment by Electronic Funds Transfer—Other Than Central Contractor Registration), or applicable agency procedures.

(C) EFT banking information is not required if the Government waived the requirement to pay by EFT.

(xi) Any other information or documentation required by the contract.

(3) *Interest penalty.* The designated payment office will pay an interest penalty automatically, without request from the Contractor, if payment is not made by the due date and the conditions listed in paragraphs (a)(3)(i) through (a)(3)(iii) of this clause are met, if applicable. However, when the due date falls on a Saturday, Sunday, or legal holiday, the designated payment office may make payment on the following working day without incurring a late payment interest penalty.

(i) The designated billing office received a proper invoice.

(ii) The Government processed a receiving report or other Government documentation authorizing payment and there was no disagreement over quantity, quality, Contractor compliance with any contract term or condition, or requested progress payment amount.

(iii) In the case of a final invoice for any balance of funds due the Contractor for work or services performed, the amount was not subject to further contract settlement actions between the Government and the Contractor.

(4) *Computing penalty amount.* The Government will compute the interest penalty in accordance with the Office of Management and Budget prompt payment regulations at 5 CFR part 1315.

(i) For the sole purpose of computing an interest penalty that might be due the Contractor for payments described in paragraph (a)(1)(ii) of this clause, Government acceptance or approval is deemed to occur constructively on the 7th day after the Contractor has completed the work or services in accordance with the terms and conditions of the contract. If actual acceptance or approval occurs within the constructive acceptance or approval period, the Government will base the determination of an interest penalty on the actual date

of acceptance or approval. Constructive acceptance or constructive approval requirements do not apply if there is a disagreement over quantity, quality, or Contractor compliance with a contract provision. These requirements also do not compel Government officials to accept work or services, approve Contractor estimates, perform contract administration functions, or make payment prior to fulfilling their responsibilities.

(ii) The prompt payment regulations at 5 CFR 1315.10(c) do not require the Government to pay interest penalties if payment delays are due to disagreement between the Government and the Contractor over the payment amount or other issues involving contract compliance, or on amounts temporarily withheld or retained in accordance with the terms of the contract. The Government and the Contractor shall resolve claims involving disputes, and any interest that may be payable in accordance with the clause at FAR 52.233-1, Disputes.

(5) *Discounts for prompt payment.* The designated payment office will pay an interest penalty automatically, without request from the Contractor, if the Government takes a discount for prompt payment improperly. The Government will calculate the interest penalty in accordance with the prompt payment regulations at 5 CFR part 1315.

(6) *Additional interest penalty.* (i) The designated payment office will pay a penalty amount, calculated in accordance with the prompt payment regulations at 5 CFR part 1315 in addition to the interest penalty amount only if—

(A) The Government owes an interest penalty of \$1 or more;

(B) The designated payment office does not pay the interest penalty within 10 days after the date the invoice amount is paid; and

(C) The Contractor makes a written demand to the designated payment office for additional penalty payment, in accordance with paragraph (a)(6)(ii) of this clause, postmarked not later than 40 days after the date the invoice amount is paid.

(ii)(A) The Contractor shall support written demands for additional penalty payments with the following data. The Government will not request any additional data. The Contractor shall—

(1) Specifically assert that late payment interest is due under a specific invoice, and request payment of all overdue late payment interest penalty and such additional penalty as may be required;

(2) Attach a copy of the invoice on which the unpaid late payment interest was due; and

(3) State that payment of the principal has been received, including the date of receipt.

(B) If there is no postmark or the postmark is illegible—

(1) The designated payment office that receives the demand will annotate it with the date of receipt provided the demand is received on or before the 40th day after payment was made; or

(2) If the designated payment office fails to make the required annotation, the Government will determine the demand's validity based on the date the Contractor has placed on the demand, provided such date is no later than the 40th day after payment was made.

(b) *Contract financing payments.* If this contract provides for contract financing, the Government will make contract financing payments in accordance with the applicable contract financing clause.

(c) *Subcontract clause requirements.* The Contractor shall include in each subcontract for property or services (including a material supplier) for the purpose of performing this contract the following:

(1) *Prompt payment for subcontractors.* A payment clause that obligates the Contractor to pay the subcontractor for satisfactory performance under its subcontract not later than 7 days from receipt of payment out of such amounts as are paid to the Contractor under this contract.

(2) *Interest for subcontractors.* An interest penalty clause that obligates the Contractor to pay to the subcontractor an interest penalty for each payment not made in accordance with the payment clause—

(i) For the period beginning on the day after the required payment date and ending on the date on which payment of the amount due is made; and

(ii) Computed at the rate of interest established by the Secretary of the Treasury, and published in the **Federal Register**, for interest payments under section 12 of the Contract Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty.

(3) *Subcontractor clause flowdown.* A clause requiring each subcontractor to

(i) Include a payment clause and an interest penalty clause conforming to the standards set forth in paragraphs (c)(1) and (c)(2) of this clause in each of its subcontracts; and

(ii) Require each of its subcontractors to include such clauses in their subcontracts with each lower-tier subcontractor or supplier.

(d) *Subcontract clause interpretation.* The clauses required by paragraph (c) of this clause shall not be construed to impair the right of the Contractor or a subcontractor at any tier to negotiate, and to include in their subcontract, provisions that—

(1) *Retainage permitted.* Permit the Contractor or a subcontractor to retain (without cause) a specified percentage of each progress payment otherwise due to a subcontractor for satisfactory performance under the subcontract without incurring any obligation to pay a late payment interest penalty, in accordance with terms and conditions agreed to by the parties to the subcontract, giving such recognition as the parties deem appropriate to the ability of a subcontractor to furnish a performance bond and a payment bond;

(2) *Withholding permitted.* Permit the Contractor or subcontractor to make a determination that part or all of the subcontractor's request for payment may be withheld in accordance with the subcontract agreement; and

(3) *Withholding requirements.* Permit such withholding without incurring any obligation to pay a late payment penalty if—

(i) A notice conforming to the standards of paragraph (g) of this clause previously has been furnished to the subcontractor; and

(ii) The Contractor furnishes to the Contracting Officer a copy of any notice issued by a Contractor pursuant to paragraph (d)(3)(i) of this clause.

(e) *Subcontractor withholding procedures.* If a Contractor, after making a request for payment to the Government but before making a payment to a subcontractor for the subcontractor's performance covered by the payment request, discovers that all or a portion of the payment otherwise due such subcontractor is subject to withholding from the subcontractor in accordance with the subcontract agreement, then the Contractor shall—

(1) *Subcontractor notice.* Furnish to the subcontractor a notice conforming to the standards of paragraph (g) of this clause as soon as practicable upon ascertaining the cause giving rise to a withholding, but prior to the due date for subcontractor payment;

(2) *Contracting Officer notice.* Furnish to the Contracting Officer, as soon as practicable, a copy of the notice furnished to the subcontractor pursuant to paragraph (e)(1) of this clause;

(3) *Subcontractor progress payment reduction.* Reduce the subcontractor's progress payment by an amount not to exceed the amount specified in the notice of withholding furnished under paragraph (e)(1) of this clause;

(4) *Subsequent subcontractor payment.* Pay the subcontractor as soon as practicable after the correction of the identified subcontract performance deficiency, and—

(i) Make such payment within—

(A) Seven days after correction of the identified subcontract performance deficiency (unless the funds therefor must be recovered from the Government because of a reduction under paragraph (e)(5)(i)) of this clause; or

(B) Seven days after the Contractor recovers such funds from the Government;

or

(ii) Incur an obligation to pay a late payment interest penalty computed at the rate of interest established by the Secretary of the Treasury, and published in the **Federal Register**, for interest payments under section 12 of the Contracts Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty;

(5) *Notice to Contracting Officer.* Notify the Contracting Officer upon—

(i) Reduction of the amount of any subsequent certified application for payment; or

(ii) Payment to the subcontractor of any withheld amounts of a progress payment,

specifying—

(A) The amounts withheld under paragraph (e)(1) of this clause; and

(B) The dates that such withholding began and ended; and

(6) *Interest to Government.* Be obligated to pay to the Government an amount equal to interest on the withheld payments (computed in the manner provided in 31 U.S.C. 3903(c)(1)), from the 8th day after receipt of the withheld amounts from the Government until—

- (i) The day the identified subcontractor performance deficiency is corrected; or
- (ii) The date that any subsequent payment is reduced under paragraph (e)(5)(i) of this

clause.

(f) *Third-party deficiency reports*—(1) *Withholding from subcontractor*. If a Contractor, after making payment to a first-tier subcontractor, receives from a supplier or subcontractor of the first-tier subcontractor (hereafter referred to as a “second-tier subcontractor”) a written notice in accordance with section 2 of the Act of August 24, 1935 (40 U.S.C. 270b, Miller Act), asserting a deficiency in such first-tier subcontractor’s performance under the contract for which the Contractor may be ultimately liable, and the Contractor determines that all or a portion of future payments otherwise due such first-tier subcontractor is subject to withholding in accordance with the subcontract agreement, the Contractor may, without incurring an obligation to pay an interest penalty under paragraph (e)(6) of this clause—

(i) Furnish to the first-tier subcontractor a notice conforming to the standards of paragraph (g) of this clause as soon as practicable upon making such determination; and

(ii) Withhold from the first-tier subcontractor’s next available progress payment or payments an amount not to exceed the amount specified in the notice of withholding furnished under paragraph (f)(1)(i) of this clause.

(2) *Subsequent payment or interest charge*. As soon as practicable, but not later than 7 days after receipt of satisfactory written notification that the identified subcontract performance deficiency has been corrected, the Contractor shall—

(i) Pay the amount withheld under paragraph (f)(1)(ii) of this clause to such first-tier subcontractor; or

(ii) Incur an obligation to pay a late payment interest penalty to such first-tier subcontractor computed at the rate of interest established by the Secretary of the Treasury, and published in the **Federal Register**, for interest payments under section 12 of the Contracts Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty.

(g) *Written notice of subcontractor withholding*. The Contractor shall issue a written notice of any withholding to a subcontractor (with a copy furnished to the Contracting Officer), specifying—

(1) The amount to be withheld;

(2) The specific causes for the withholding under the terms of the subcontract; and

(3) The remedial actions to be taken by the subcontractor in order to receive payment of the

amounts withheld.

(h) *Subcontractor payment entitlement*. The Contractor may not request payment from the Government of any amount withheld or retained in accordance with paragraph (d) of this clause until such time as the Contractor has determined and certified to the Contracting Officer that the subcontractor is entitled to the payment of such amount.

(i) *Prime-subcontractor disputes*. A dispute between the Contractor and subcontractor relating to the amount or entitlement of a subcontractor to a payment or a late payment interest penalty under a clause included in the subcontract pursuant to paragraph (c) of this clause does not constitute a dispute to which the Government is a party. The Government may not be interpleaded in any judicial or administrative proceeding involving such a dispute.

(j) *Preservation of prime-subcontractor rights*. Except as provided in paragraph (i) of this clause, this clause shall not limit or impair any contractual, administrative, or judicial remedies otherwise available to the Contractor or a subcontractor in the event of a dispute involving late payment or nonpayment by the Contractor or deficient subcontract performance or nonperformance by a subcontractor.

(k) *Non-recourse for prime contractor interest penalty*. The Contractor’s obligation to pay an interest penalty to a subcontractor pursuant to the clauses included in a subcontract under paragraph (c) of this clause shall not be construed to be an obligation of the Government for such interest penalty. A cost-reimbursement claim may not include any amount for reimbursement of such interest penalty.

(l) *Overpayments*. If the Contractor becomes aware of a duplicate payment or that the Government has otherwise overpaid on an invoice payment, the Contractor shall immediately notify the Contracting Officer and request instructions for disposition of the overpayment.

(End of clause)

**82. \*FAR 52.232-33 PAYMENT BY ELECTRONIC FUNDS TRANSFER –CENTRAL CONTRACTOR REGISTRATION (MAY 1999)**

(a) *Method of payment.* (1) All payments by the Government under this contract shall be made by electronic funds transfer (EFT), except as provided in paragraph (a)(2) of this clause. As used in this clause, the term “EFT” refers to the funds transfer and may also include the payment information transfer.

(2) In the event the Government is unable to release one or more payments by EFT, the Contractor agrees to either—

(i) Accept payment by check or some other mutually agreeable method of payment; or

(ii) Request the Government to extend the payment due date until such time as the Government can make payment by EFT (but see paragraph (d) of this clause).

(b) *Contractor’s EFT information.* The Government shall make payment to the Contractor using the EFT information contained in the Central Contractor Registration (CCR) database. In the event that the EFT information changes, the Contractor shall be responsible for providing the updated information to the CCR database.

(c) *Mechanisms for EFT payment.* The Government may make payment by EFT through either the Automated Clearing House (ACH) network, subject to the rules of the National Automated Clearing House Association, or the Fedwire Transfer System. The rules governing Federal payments through the ACH are contained in 31 CFR part 210.

(d) *Suspension of payment.* If the Contractor’s EFT information in the CCR database is incorrect, then the Government need not make payment to the Contractor under this contract until correct EFT information is entered into the CCR database; and any invoice or contract financing request shall be deemed not to be a proper invoice for the purpose of prompt payment under this contract. The prompt payment terms of the contract regarding notice of an improper invoice and delays in accrual of interest penalties apply.

(e) *Contractor EFT arrangements.* If the Contractor has identified multiple payment receiving points (i.e., more than one remittance address and/or EFT information set) in the CCR database, and the Contractor has not notified the Government of the payment receiving point applicable to this contract, the Government shall make payment to the first payment receiving point (EFT information set or remittance address as applicable) listed in the CCR database.

(f) *Liability for uncompleted or erroneous transfers.* (1) If an uncompleted or erroneous transfer occurs because the Government used

the Contractor’s EFT information incorrectly, the Government remains responsible for—

(i) Making a correct payment;

(ii) Paying any prompt payment penalty due; and

(iii) Recovering any erroneously directed funds.

(2) If an uncompleted or erroneous transfer occurs because the Contractor’s EFT information was incorrect, or was revised within 30 days of Government release of the EFT payment transaction instruction to the Federal Reserve System, and—

(i) If the funds are no longer under the control of the payment office, the Government is deemed to have made payment and the Contractor is responsible for recovery of any erroneously directed funds; or

(ii) If the funds remain under the control of the payment office, the Government shall not make payment, and the provisions of paragraph (d) of this clause shall apply.

(g) *EFT and prompt payment.* A payment shall be deemed to have been made in a timely manner in accordance with the prompt payment terms of this contract if, in the EFT payment transaction instruction released to the Federal Reserve System, the date specified for settlement of the payment is on or before the prompt payment due date, provided the specified payment date is a valid date under the rules of the Federal Reserve System.

(h) *EFT and assignment of claims.* If the Contractor assigns the proceeds of this contract as provided for in the assignment of claims terms of this contract, the Contractor shall require as a condition of any such assignment, that the assignee shall register in the CCR database and shall be paid by EFT in accordance with the terms of this clause. In all respects, the requirements of this clause shall apply to the assignee as if it were the Contractor. EFT information that shows the ultimate recipient of the transfer to be other than the Contractor, in the absence of a proper assignment of claims acceptable to the Government, is incorrect EFT information within the meaning of paragraph (d) of this clause.

(i) *Liability for change of EFT information by financial agent.* The Government is not liable for errors

resulting from changes to EFT information made by the Contractor's financial agent.

(j) *Payment information.* The payment or disbursing office shall forward to the Contractor available payment information that is suitable for transmission as of the date of release of the EFT instruction to the Federal Reserve System. The Government may request the Contractor to designate a desired format and method(s) for delivery of payment information from a list of formats and methods the payment office is capable of executing. However, the Government does not guarantee that any particular format or method of delivery is available at any particular payment office and retains the latitude to use the format and delivery method most convenient to the Government. If the Government makes payment by check in accordance with paragraph (a) of this clause, the Government shall mail the payment information to the remittance address contained in the CCR database.  
(End of Clause)

**83. DFARS 252.232-7004 DOD PROGRESS PAYMENT RATES (OCT 2001)**

(a) If the contractor is a small business concern, the Progress Payments clause of this contract is modified to change each mention of the progress payment rate and liquidation rate (excepting paragraph (k), *Limitations on Unfinalized Contract Actions*) to 90 percent.

(b) If the contractor is a small disadvantaged business concern, the Progress Payments clause of this contract is modified to change each mention of the progress payment rate and liquidation rate (excepting paragraph (k), *Limitations on Unfinalized Contract Actions*) to 95 percent.  
(End of clause)

**84. DFARS 252.232-7005 REIMBURSEMENT OF SUBCONTRACTOR ADVANCE PAYMENTS--  
DOD PILOT MENTOR-PROTEGE PROGRAM (SEP 2001)**

(a) The Government will reimburse the Contractor for any advance payments made by the Contractor, as a mentor firm, to a protege firm, pursuant to an approved mentor-protege agreement, provided-

(1) The Contractor's subcontract with the protege firm includes a provision substantially the same as FAR 52.232-12, Advance Payments;  
(2) The Contractor has administered the advance payments in accordance with the policies of FAR Subpart 32.4; and

(3) The Contractor agrees that any financial loss resulting from the failure or inability of the protege firm to repay any unliquidated advance payments is the sole financial responsibility of the Contractor.

(b) For a fixed price type contract, advance payments made to a protege firm shall be paid and administered as if they were 100 percent progress payments. The Contractor shall include as a separate attachment with each Standard Form (SF) 1443, Contractor's Request for Progress Payment, a request for reimbursement of advance payments made to a protege firm. The attachment shall provide a separate calculation of lines 14a through 14e of SF 1443 for each protege, reflecting the status of advance payments made to that protege.

(c) For cost reimbursable contracts, reimbursement of advance payments shall be made via public voucher. The Contractor shall show the amounts of advance payments made to each protege on the public voucher, in the form and detail directed by the cognizant contracting officer or contract auditor.  
(End of clause)

**85. \*FAR 52.233-1 DISPUTES (JULY 2002)**

(a) This contract is subject to the Contract Disputes Act of 1978, as amended (41 U.S.C. 601-613).

(b) Except as provided in the Act, all disputes arising under or relating to this contract shall be resolved under this clause.

(c) "Claim," as used in this clause, means a written demand or written assertion by one of the contracting parties seeking, as a matter of right, the payment of money in a sum certain, the adjustment or interpretation of contract terms, or other relief arising under or relating to this contract. However, a written demand or written

assertion by the Contractor seeking the payment of money exceeding \$100,000 is not a claim under the Act until certified. A voucher, invoice, or other routine request for payment that is not in dispute when submitted is not a claim under the Act. The submission may be converted to a claim under the Act, by complying with the submission and certification requirements of this clause, if it is disputed either as to liability or amount or is not acted upon in a reasonable time.

(d)(1) A claim by the Contractor shall be made in writing and, unless otherwise stated in this contract, submitted within 6 years after accrual of the claim to the Contracting Officer for a written decision. A claim by the Government against the Contractor shall be subject to a written decision by the Contracting Officer.

(2) (i) Contractors shall provide the certification specified in paragraph (d)(2)(iii) of this clause when submitting any claim exceeding \$100,000.

(ii) The certification requirement does not apply to issues in controversy that have not been submitted as all or part of a claim.

(iii) The certification shall state as follows:

'I certify that the claim is made in good faith; that the supporting data are accurate and complete to the best of my knowledge and belief; that the amount requested accurately reflects the contract adjustment for which the Contractor believes the Government is liable; and that I am duly authorized to certify the claim on behalf of the Contractor.'

(3) The certification may be executed by any person duly authorized to bind the Contractor with respect to the claim.

(e) For Contractor claims of \$100,000 or less, the Contracting Officer must, if requested in writing by the Contractor, render a decision within 60 days of the request. For Contractor-certified claims over \$100,000, the Contracting Officer must, within 60 days, decide the claim or notify the Contractor of the date by which the decision will be made.

(f) The Contracting Officer's decision shall be final unless the Contractor appeals or files a suit as provided in the Act.

(g) If the claim by the Contractor is submitted to the Contracting Officer or a claim by the Government is presented to the Contractor, the parties, by mutual consent, may agree to use alternative dispute resolution (ADR). If the Contractor refuses an offer for ADR, the Contractor shall inform the Contracting Officer, in writing, of the Contractor's specific reasons for rejecting the offer.

(h) The Government shall pay interest on the amount found due and unpaid from (1) the date the Contracting Officer receives the claim (certified if required), or (2) the date that payment otherwise would be due, if that date is later, until the date of payment. With regard to claims having defective certifications, as defined in (FAR) 48 CFR 33.201, interest shall be paid from the date that the Contracting Officer initially receives the claim. Simple interest on claims shall be paid at the rate, fixed by the Secretary of the Treasury as provided in the Act, which is applicable to the period during which the Contracting Officer receives the claim and then at the rate applicable for each 6-month period as fixed by the Treasury Secretary during the pendency of the claim.

(i) The Contractor shall proceed diligently with performance of this contract, pending final resolution of any request for relief, claim, appeal, or action arising under the contract, and comply with any decision of the Contracting Officer.

## **86. \*FAR 52.233-3 PROTEST AFTER AWARD (AUG 1996)**

(a) Upon receipt of a notice of protest (as defined in FAR 33.101) or a determination that a protest is likely (see FAR 33.102(d)), the Contracting Officer may, by written order to the Contractor, direct the Contractor to stop performance of the work called for by this contract. The order shall be specifically identified as a stop-work order issued under this clause. Upon receipt of the order, the Contractor shall immediately comply with its terms and take all reasonable steps to minimize the incurrence of costs allocable to the work covered by the order during the period of work stoppage. Upon receipt of the final decision in the protest, the Contracting Officer shall either--

(1) Cancel the stop-work order; or

(2) Terminate the work covered by the order as provided in the Default, or the Termination for Convenience of the Government, clause of this contract.

(b) If a stop-work order issued under this clause is canceled either before or after a final decision in the protest, the Contractor shall resume work. The Contracting Officer shall make an equitable adjustment in the delivery schedule or contract price, or both, and the contract shall be modified, in writing, accordingly, if--

(1) The stop-work order results in an increase in the time required for, or in the Contractor's cost properly allocable to, the performance of any part of this contract; and

(2) The Contractor asserts its right to an adjustment within 30 days after the end of the period of work stoppage; provided, that if the Contracting Officer decides the facts justify the action, the Contracting Officer may receive and act upon a proposal at any time before final payment under this contract.

(c) If a stop-work order is not canceled and the work covered by the order is terminated for the convenience of the Government, the Contracting Officer shall allow reasonable costs resulting from the stop-work order in arriving at the termination settlement.

(d) If a stop-work order is not canceled and the work covered by the order is terminated for default, the Contracting Officer shall allow, by equitable adjustment or otherwise, reasonable costs resulting from the stop-work order.

(e) The Government's rights to terminate this contract at any time are not affected by action taken under this clause.

(f) If, as the result of the Contractor's intentional or negligent misstatement, misrepresentation, or miscertification, a protest related to this contract is sustained, and the Government pays costs, as provided in FAR 33.102(b)(2) or 33.104(h)(1), the Government may require the Contractor to reimburse the Government the amount of such costs. In addition to any other remedy available, and pursuant to the requirements of Subpart 32.6, the Government may collect this debt by offsetting the amount against any payment due the Contractor under any contract between the Contractor and the Government.

## **87. RESERVED**

## **88. FAR 52.236-2 DIFFERING SITE CONDITIONS (APR 1984)**

(a) The Contractor shall promptly, and before the conditions are disturbed, give a written notice to the Contracting Officer of

(1) subsurface or latent physical conditions at the site which differ materially from those indicated in this contract, or

(2) unknown physical conditions at the site, of an unusual nature, which differ materially from those ordinarily encountered and generally recognized as inhering in work of the character provided for in the contract.

(b) The Contracting Officer shall investigate the site conditions promptly after receiving the notice. If the conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performing any part of the work under this contract, whether or not changed as a result of the conditions, an equitable adjustment shall be made under this clause and the contract modified in writing accordingly.

(c) No request by the Contractor for an equitable adjustment to the contract under this clause shall be allowed, unless the Contractor has given the written notice required, provided, that the time prescribed in (a) above for giving written notice may be extended by the Contracting Officer.

(d) No request by the Contractor for an equitable adjustment to the contract for differing site conditions shall be allowed if made after final payment under this contract.

## **89. \*FAR 52.236-3 SITE INVESTIGATION AND CONDITIONS AFFECTING THE WORK (APR 1984)**

(a) The Contractor acknowledges that it has taken steps reasonably necessary to ascertain the nature and location of the work, and that it has investigated and satisfied itself as to the general and local conditions which can affect the work or its cost, including but not limited to

- (1) conditions bearing upon transportation, disposal, handling, and storage of materials;
- (2) the availability of labor, water, electric power, and roads;
- (3) uncertainties of weather, river stages, tides, or similar physical conditions at the site;
- (4) the conformation and conditions of the ground; and
- (5) the character of equipment and facilities needed preliminary to and during work

performance. The Contractor also acknowledges that it has satisfied itself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including all exploratory work done by the Government, as well as from the drawings and specifications made a part of this contract. Any failure of the Contractor to take the actions described and acknowledged in this paragraph will not relieve the Contractor from responsibility for estimating properly the difficulty and cost of successfully performing the work, or for proceeding to successfully perform the work without additional expense to the Government.

(b) The Government assumes no responsibility for any conclusions or interpretations made by the Contractor based on the information made available by the Government. Nor does the Government assume responsibility for any understanding reached or representation made concerning conditions which can affect the work by any of its officers or agents before the execution of this contract, unless that understanding or representation is expressly stated in this contract.

#### **90. \*FAR 52.236-5 MATERIAL AND WORKMANSHIP (APR 1984)**

(a) All equipment, material, and articles incorporated into the work covered by this contract shall be new and of the most suitable grade for the purpose intended, unless otherwise specifically provided in this contract. References in the specifications to equipment, material, articles, or patented processes by trade name, make, or catalog number, shall be regarded as establishing a standard of quality and shall not be construed as limiting competition. The Contractor may, at its option, use any equipment, material, article, or process that, in the judgment of the Contracting Officer, is equal to that named in the specifications, unless otherwise specifically provided in this contract.

(b) The Contractor shall obtain the Contracting Officer's approval of the machinery and mechanical and other equipment to be incorporated into the work. When requesting approval, the Contractor shall furnish to the Contracting Officer the name of the manufacturer, the model number, and other information concerning the performance, capacity, nature, and rating of the machinery and mechanical and other equipment. When required by this contract or by the Contracting Officer, the Contractor shall also obtain the Contracting Officer's approval of the material or articles which the Contractor contemplates incorporating into the work. When requesting approval, the Contractor shall provide full information concerning the material or articles. When directed to do so, the Contractor shall submit samples for approval at the Contractor's expense, with all shipping charges prepaid. Machinery, equipment, material, and articles that do not have the required approval shall be installed or used at the risk of subsequent rejection.

(c) All work under this contract shall be performed in a skillful and workmanlike manner. The Contracting Officer may require, in writing, that the Contractor remove from the work any employee the Contracting Officer deems incompetent, careless, or otherwise objectionable.

#### **91. RESERVED**

#### **92. \*FAR 52.236-6 SUPERINTENDENCE BY THE CONTRACTOR (APR 1984)**

At all times during performance of this contract and until the work is completed and accepted, the Contractor shall directly superintend the work or assign and have on the work site a competent superintendent who is satisfactory to the Contracting Officer and has authority to act for the Contractor.

**93. FAR 52.236-7 PERMITS AND RESPONSIBILITIES (NOV 1991)**

The Contractor shall, without additional expense to the Government, be responsible for obtaining any necessary licenses and permits, and for complying with any Federal, State, and municipal laws, codes, and regulations applicable to the performance of the work. The Contractor shall also be responsible for all damages to persons or property that occur as a result of the Contractor's fault or negligence. The Contractor shall also be responsible for all materials delivered and work performed until completion and acceptance of the entire work, except for any completed unit of work which may have been accepted under the contract.

**94. \*FAR 52.236-8 OTHER CONTRACTS (APR 1984)**

The Government may undertake or award other contracts for additional work at or near the site of the work under this contract. The Contractor shall fully cooperate with the other contractors and with Government employees and shall carefully adapt scheduling and performing the work under this contract to accommodate the additional work, heeding any direction that may be provided by the Contracting Officer. The Contractor shall not commit or permit any act that will interfere with the performance of work by any other contractor or by Government employees.

**95. \*FAR 52.236-9 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS (APR 1984)**

(a) The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.

(b) The Contractor shall protect from damage all existing improvements and utilities

- (1) at or near the work site, and
- (2) on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refused to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

**96. \*FAR 52.236-10 OPERATIONS AND STORAGE AREAS (APR 1984)**

(a) The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.

(b) Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.

(c) The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading

capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

**97. \*FAR 52.236-11 USE AND POSSESSION PRIOR TO COMPLETION (APR 1984)**

(a) The Government shall have the right to take possession of or use any completed or partially completed part of the work. Before taking possession of or using any work, the Contracting Officer shall furnish the Contractor a list of items of work remaining to be performed or corrected on those portions of the work that the Government intends to take possession of or use. However, failure of the Contracting Officer to list any item of work shall not relieve the Contractor of responsibility for complying with the terms of the contract. The Government's possession or use shall not be deemed an acceptance of any work under the contract.

(b) While the Government has such possession or use, the Contractor shall be relieved of the responsibility for the loss of or damage to the work resulting from the Government's possession or use, notwithstanding the terms of the clause in this contract entitled "Permits and Responsibilities." If prior possession or use by the Government delays the progress of the work or causes additional expense to the Contractor, an equitable adjustment shall be made in the contract price or the time of completion, and the contract shall be modified in writing accordingly.

**98. \*FAR 52.236-12 CLEANING UP (APR 1984)**

The Contractor shall at all times keep the work area, including storage areas, free from accumulations of waste materials. Before completing the work, the Contractor shall remove from the work and premises any rubbish, tools, scaffolding, equipment, and materials that are not the property of the Government. Upon completing the work, the Contractor shall leave the work area in a clean, neat, and orderly condition satisfactory to the Contracting Officer.

**99. \*FAR 52.236-13 ACCIDENT PREVENTION-ALTERNATE I (NOV 1991)**

(a) The Contractor shall provide and maintain work environments and procedures which will (1) safeguard the public and Government personnel, property, materials, supplies, and equipment exposed to Contractor operations and activities; (2) avoid interruptions of Government operations and delays in project completion dates; and (3) control costs in the performance of this contract.

(b) For these purposes on contracts for construction or dismantling, demolition, or removal of improvements, the Contractor shall--

- (1) Provide appropriate safety barricades, signs, and signal lights;
- (2) Comply with the standards issued by the Secretary of Labor at 29 CFR Part 1926 and 29 CFR Part 1910; and
- (3) Ensure that any additional measures the Contracting Officer determines to be reasonably necessary for the purposes are taken.

(c) If this contract is for construction or dismantling, demolition or removal of improvements with any Department of Defense agency or component, the Contractor shall comply with all pertinent provisions of the latest version of U.S. Army Corps of engineers Safety and Health Requirements Manual, EM 385-1-1, in effect on the date of the solicitation.

(d) Whenever the Contracting Officer becomes aware of any noncompliance with these requirements or any condition which poses a serious or imminent danger to the health or safety of the public or Government personnel, the Contracting Officer shall notify the Contractor orally, with written confirmation, and request immediate initiation of corrective action. This notice, when delivered to the Contractor or the Contractor's representative at the work site, shall be deemed sufficient notice of the noncompliance and that corrective action is required. After receiving the notice, the Contractor shall immediately take corrective action. If the Contractor fails

or refuses to promptly take corrective action, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. The Contractor shall not be entitled to any equitable adjustment of the contract price or extension of the performance schedule on any stop work order issued under this clause.

(e) The Contractor shall insert this clause, including this paragraph (e), with appropriate changes in the designation of the parties, in subcontractors.

(f) Before commencing the work, the Contractor shall--

(1) Submit a written proposed plan for implementing this clause. The plan shall include an analysis of the significant hazards to life, limb, and property inherent in contract work performance and a plan for controlling these hazards; and

(2) Meet with representatives of the Contracting Officer to discuss and develop a mutual understanding relative to administration of the overall safety program.

#### **100.\*FAR 52.236-14 AVAILABILITY AND USE OF UTILITY SERVICES (APR 1984)**

(a) The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. Unless otherwise provided in the contract, the amount of each utility service consumed shall be charged to or paid for by the Contractor at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by the Contracting Officer. The Contractor shall carefully conserve any utilities furnished without charge.

(b) The Contractor, at its expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of each utility used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.

#### **101.FAR 52.236-15 SCHEDULES FOR CONSTRUCTION CONTRACTS (APR 1984)**

(a) The Contractor shall, within five days after the work commences on the contract or another period of time determined by the Contracting Officer, prepare and submit to the Contracting Officer for approval three copies of a practicable schedule showing the order in which the Contractor proposes to perform the work, and the dates on which the Contractor contemplates starting and completing the several salient features of the work (including acquiring materials, plant, and equipment). The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion by any given date during the period. If the Contractor fails to submit a schedule within the time prescribed, the Contracting Officer may withhold approval of progress payments until the Contractor submits the required schedule.

(b) The Contractor shall enter the actual progress on the chart as directed by the Contracting Officer, and upon doing so shall immediately deliver three copies of the annotated schedule to the Contracting Officer. If, in the opinion of the Contracting Officer, the Contractor falls behind the approved schedule, the Contractor shall take steps necessary to improve its progress, including those that may be required by the Contracting Officer, without additional cost to the Government. In this circumstance, the Contracting Officer may require the Contractor to increase the number of shifts, overtime operations, days of work, and/or the amount of construction plant, and to submit for approval any supplementary schedule or schedules in chart form as the Contracting Officer deems necessary to demonstrate how the approved rate of progress will be regained.

(c) Failure of the Contractor to comply with the requirements of the Contracting Officer under this clause shall be grounds for a determination by the Contracting Officer that the Contractor is not prosecuting the work with sufficient diligence to ensure completion within the time specified in the contract. Upon making this determination, the Contracting Officer may terminate the Contractor's right to proceed with the work, or any separable part of it, in accordance with the default terms of this contract.

**102.\*FAR 52.236-17 LAYOUT OF WORK (APR 1984)**

The Contractor shall lay out its work from Government-established base lines and bench marks indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at its own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Contracting Officer. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Contracting Officer until authorized to remove them. If such marks are destroyed by the Contractor or through its negligence before their removal is authorized, the Contracting Officer may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

**103.FAR 52.236-21 SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FEB 1997)**

(a) The Contractor shall keep on the work site a copy of the drawings and specifications and shall at all times give the Contracting Officer access thereto. Anything mentioned in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawings and specifications, the specifications shall govern. In case of discrepancy in the figures, in the drawings, or in the specifications, the matter shall be promptly submitted to the Contracting Officer, who shall promptly make a determination in writing. Any adjustment by the Contractor without such a determination shall be at its own risk and expense. The Contracting Officer shall furnish from time to time such detailed drawings and other information as considered necessary, unless otherwise provided.

(b) Wherever in the specifications or upon the drawings the words "directed," "required," "ordered," "designated," "prescribed," or words of like import are used, it shall be understood that the "direction," "requirement," "order," "designation," or "prescription," of the Contracting Officer is intended and similarly the words "approved," "acceptable," "satisfactory," or words of like import shall mean "approved by," or "acceptable to," or "satisfactory to" the Contracting Officer, unless otherwise expressly stated.

(c) Where "as shown," "as indicated," "as detailed," or words of similar import are used, it shall be understood that the reference is made to the drawings accompanying this contract unless stated otherwise. The word "provided" as used herein shall be understood to mean "provide complete in place," that is "furnished and installed."

(d) Shop drawings means drawings, submitted to the Government by the Contractor, subcontractor, or any lower tier subcontractor pursuant to a construction contract, showing in detail

(1) the proposed fabrication and assembly of structural elements, and

(2) the installation (i.e., fit, and attachment details) of materials or equipment. It includes drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials furnished by the Contractor to explain in detail specific portions of the work required by the contract. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

(e) If this contract requires shop drawings, the Contractor shall coordinate all such drawings, and review them for accuracy, completeness, and compliance with contract requirements and shall indicate its approval thereon as evidence of such coordination and review. Shop drawings submitted to the Contracting Officer without evidence of the Contractor's approval may be returned for resubmission. The Contracting Officer will indicate an approval or disapproval of the shop drawings and if not approved as submitted shall indicate the Government's reasons therefor. Any work done before such approval shall be at the Contractor's risk. Approval by the Contracting Officer shall not relieve the Contractor from responsibility for any errors or omissions in such drawings, nor from responsibility for complying with the requirements of this contract, except with respect to variations described and approved in accordance with (f) below.

(f) If shop drawings show variations from the contract requirements, the Contractor shall describe such variations in writing, separate from the drawings, at the time of submission. If the Contracting Officer approves any such variation, the Contracting Officer shall issue an appropriate contract modification, except that, if the variation is minor or does not involve a change in price or in time of performance, a modification need not be issued.

(g) The Contractor shall submit to the Contracting Officer for approval four copies (unless otherwise indicated) of all shop drawings as called for under the various headings of these specifications. Three sets (unless otherwise indicated) of all shop drawings, will be retained by the Contracting Officer and one set will be returned to the Contractor.

**104. \*FAR 52.236-26 PRECONSTRUCTION CONFERENCE (FEB 1995)**

If the Contracting Officer decides to conduct a preconstruction conference, the successful offeror will be notified and will be required to attend. The Contracting Officer's notification will include specific details regarding the date, time, and location of the conference, any need for attendance by subcontractors, and information regarding the items to be discussed.

**105. DFARS 252.236-7000 MODIFICATION OF PROPOSALS - PRICE BREAKDOWN (DEC 1991)**

- (a) The Contractor shall furnish a price breakdown, itemized as required and within the time specified by the Contracting Officer, with any proposal for a contract modification.
- (b) The price breakdown--
  - (1) Must include sufficient detail to permit an analysis of profit, and of all costs for--
    - (i) Material;
    - (ii) Labor,
    - (iii) Equipment;
    - (iv) Subcontracts; and
  - (2) Must cover all work involved in the modification, whether the work was deleted, added, or changed.
- (c) The Contractor shall provide similar price breakdowns to support any amounts claimed for subcontracts.
- (d) The Contractor's proposal shall include a justification for any time extension proposed.

**106. DFARS 252.236-7008 CONTRACT PRICES - BIDDING SCHEDULES (DEC 1991)**

- (a) The Government's payment for the items listed in the Bidding Schedule shall constitute full compensation to the Contractor for--
  - (1) Furnishing all plant, labor, equipment, appliances, and materials; and
  - (2) Performing all operations required to complete the work in conformity with the drawings and specifications.
- (b) The Contractor shall include in the prices for the items listed in the Bidding Schedule all costs for work in the specifications, whether or not specifically listed in the Bidding Schedule.

**107. \*FAR 52.242-13 BANKRUPTCY (JUL 1995)**

In the event the Contractor enters into proceedings relating to bankruptcy, whether voluntary or involuntary, the Contractor agrees to furnish, by certified mail or electronic commerce method authorized by the contract, written notification of the bankruptcy to the Contracting Officer responsible for administering the contract. This notification shall be furnished within five days of the initiation of the proceedings relating to bankruptcy filing. This notification shall include the date on which the bankruptcy petition was filed, the identity of the court in which the bankruptcy petition was filed, and a listing of Government contract numbers and contracting offices for all Government contracts against which final payment has not been made. This obligation remains in effect until final payment under this contract.

**108. \*FAR 52.242-14 SUSPENSION OF WORK (APR 1984)**

(a) The Contracting Officer may order the Contractor, in writing, to suspend, delay, or interrupt all or any part of the work of this contract for the period of time that the Contracting Officer determines appropriate for the convenience of the Government.

(b) If the performance of all or any part of the work is, for an unreasonable period of time, suspended, delayed, or interrupted (1) by an act of the Contracting Officer in the administration of this contract, or (2) by the Contracting Officer's failure to act within the time specified in this contract (or within a reasonable time if not specified), an adjustment shall be made for any increase in the cost of performance of this contract (excluding profit) necessarily caused by the unreasonable suspension, delay, or interruption, and the contract modified in writing accordingly. However, no adjustment shall be made under this clause for any suspension, delay, or interruption to the extent that performance would have been so suspended, delayed, or interrupted by any other cause, including the fault or negligence of the Contractor, or for which an equitable adjustment is provided for or excluded under any other term or condition of this contract.

(c) A claim under this clause shall not be allowed (1) for any costs incurred more than 20 days before the Contractor shall have notified the Contracting Officer in writing of the act or failure to act involved (but this requirement shall not apply as to a claim resulting from a suspension order), and (2) unless the claim, in an amount stated, is asserted in writing as soon as practicable after the termination of the suspension, delay, or interruption, but not later than the date of final payment under the contract.

**109. FAR 52.243-4 CHANGES (AUG 1987)**

(a) The Contracting Officer may, at any time, without notice to the sureties, if any, by written order designated or indicated to be a change order, make changes in the work within the general scope of the contract, including changes--

- (1) In the specifications (including drawings and designs);
- (2) In the method or manner of performance of the work;
- (3) In the Government-furnished facilities, equipment, materials, services, or site; or
- (4) Directing acceleration in the performance of the work.

(b) Any other written or oral order (which, as used in this paragraph (b), includes direction, instruction, interpretation, or determination) from the Contracting Officer that causes a change shall be treated as a change order under this clause; provided, that the Contractor gives the Contracting Officer written notice stating

- (1) the date, circumstances, and source of the order and
- (2) that the Contractor regards the order as a change order.

(c) Except as provided in this clause, no order, statement, or conduct of the Contracting Officer shall be treated as a change under this clause or entitle the Contractor to an equitable adjustment.

(d) If any change under this clause causes an increase or decrease in the Contractor's cost of, or the time required for, the performance of any part of the work under this contract, whether or not changed by any such order, the Contracting Officer shall make an equitable adjustment and modify the contract in writing. However, except for an adjustment based on defective specifications, no adjustment for any change under paragraph (b) of this clause shall be made for any costs incurred more than 20 days before the Contractor gives written notice as required. In the case of defective specifications for which the Government is responsible, the equitable adjustment shall include any increased cost reasonably incurred by the Contractor in attempting to comply with the defective specifications.

(e) The Contractor must assert its right to an adjustment under this clause within 30 days after

- (1) receipt of a written change order under paragraph (a) of this clause or
- (2) the furnishing of a written notice under paragraph (b) of this clause, by submitting to the

Contracting Officer a written statement describing the general nature and amount of the proposal, unless this period is extended by the Government. The statement of proposal for adjustment may be included in the notice under paragraph (b) above.

(f) No proposal by the Contractor for an equitable adjustment shall be allowed if asserted after final payment under this contract.

**110. DFARS 252.243-7001 PRICING OF CONTRACT MODIFICATIONS (DEC 1991)**

When costs are a factor in any price adjustment under this contract, the contract cost principles and procedures in FAR Part 31 and DFARS Part 231, in effect on the date of this contract, apply.

**111. DFARS 252.243-7002 REQUESTS FOR EQUITABLE ADJUSTMENT (MAR 1998)**

(a) The amount of any request for equitable adjustment to contract terms shall accurately reflect the contract adjustment for which the Contractor believes the Government is liable. The request shall include only costs for performing the change, and shall not include any costs that already have been reimbursed or that have been separately claimed. All indirect costs included in the request shall be properly allocable to the change in accordance with applicable acquisition regulations.

(b) In accordance with 10 U.S.C. 2410(a), any request for equitable adjustment to contract terms that exceeds the simplified acquisition threshold shall bear, at the time of submission, the following certificate executed by an individual authorized to certify the request on behalf of the Contractor:

I certify that the request is made in good faith, and that the supporting data are accurate and complete to the best of my knowledge and belief.

-----  
(Official's Name)

-----  
(Title)

(c) The certification in paragraph (b) of this clause requires full disclosure of all relevant facts, including--

(1) Cost or pricing data if required in accordance with subsection 15.403-4 of the Federal Acquisition Regulation; and

(2) Information other than cost or pricing data, in accordance with subsection 15.403-3 of the FAR, including actual cost data and data to support any estimated costs, even if cost or pricing data are not required.

(d) The certification requirement in paragraph (b) of this clause does not apply to---

(1) Requests for routine contract payments; for example, requests for payment for accepted supplies and services, routine vouchers under a cost-reimbursement type contract, or progress payment invoices; or

(2) Final adjustment under an incentive provision of the contract.

(End of clause)

**112. \*FAR 52.244-2 SUBCONTRACTS (AUG 1998)**

(a) Definitions. As used in this clause--

"Approved purchasing system" means a Contractor's purchasing system that has been reviewed and approved in accordance with Part 44 of the Federal Acquisition Regulation (FAR).

"Consent of subcontract" means the Contracting Officer's written consent for the Contractor to enter into a particular subcontract.

"Subcontract," means any contract, as defined in FAR Subpart 2.1, entered into by a subcontractor to furnish supplies or services for performance of the the prime contract or a subcontract. It includes, but is not limited to purchase orders, and changes and modifications to purchase orders.

(b) This clause does not apply to subcontracts for special test equipment when the contract contains the clause at FAR 52.245-18, Special Test Equipment.

(c) When this clause is included in a fixed-price type contract, consent to subcontract is required only on unpriced contract actions (including unpriced modification or unpriced delivery orders), and only if required in accordance with paragraph (d) or (e) of this clause.

(d) If the Contractor does not have an approved purchasing system, consent to subcontract is required for any subcontract that--

- (1) Is of the cost-reimbursement, time-and-materials, or labor-hour type; or
- (2) Is fixed-price and exceeds--

(i) For a contract awarded by the Department of Defense, the Coast Guard, or the National Aeronautics and Space Administration, the greater of the simplified threshold or 5 percent of the total estimated cost of the contract; or

(ii) For a contract awarded by a civilian agency other than the Coast Guard and the National Aeronautics and Space Administration, either the the simplified threshold or 5 percent of the total estimated cost of the contract.

(e) If the Contractor has an approved purchasing system, the Contractor nevertheless shall obtain the Contracting Officer's written consent before placing the following subcontracts:

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\_\_\_\_\_  
\_\_\_\_\_

(f)(1) The Contractor shall notify the Contracting Officer reasonably in advance of placing any subcontract or modification thereof for which consent is required under paragraph (c), (d), or (e) of this clause, including the following information:

- (i) A description of the supplies or services to be subcontracted.
- (ii) Identification of the type of subcontract to be used.
- (iii) Identification of the proposed subcontractor.
- (iv) The proposed subcontract price.
- (v) The subcontractor's current, complete, and accurate cost or pricing data and Certificate of Current Cost or Pricing Data, if required by other contract provisions.
- (vi) The subcontractor's Disclosure Statement or Certificate relating to Cost Accounting Standards when such data are required by other provisions of this contract.
- (vii) A negotiation memorandum reflecting--
  - (A) The principal elements of the subcontract price negotiations;
  - (B) The most significant considerations controlling establishment of initial or revised prices;
  - (C) The reason cost or pricing data were or were not required;
  - (D) The extent, if any, to which the Contractor did not rely on the subcontractor's cost or pricing data in determining the price objective and in negotiating the final price;
  - (E) The extent to which it was recognized in the negotiation that the subcontractor's cost or pricing data were not accurate, complete, or current; the action taken by the Contractor and subcontractor; and the effect of any such defective data on the total price negotiated;
  - (F) The reasons for any significant difference between the Contractor's price objective and the price negotiated; and

(G) A complete explanation of the incentive fee or profit plan when incentives are used. The explanation shall identify each critical performance element, management decisions used to quantify each incentive element, reasons for the incentives, and a summary of all trade-off possibilities considered.

(2) The Contractor is not required to notify the Contracting Officer in advance of entering into any subcontract for which consent is not required under paragraph (c), (d), or (e) of this clause.

(g) Unless the consent or approval specifically provides otherwise, neither consent by the Contracting Officer to any subcontract nor approval of the Contractor's purchasing system shall constitute a determination--

(1) Of the acceptability of any subcontract terms or conditions;

(2) Of the acceptability of any cost under this contract; or

(3) To relieve the Contractor of any responsibility for performing this contract.

(h) No subcontract or modification thereof placed under this contract shall provide for payment on a cost-plus-a-percentage-of-cost basis, and any fee payable under cost-reimbursement subcontracts shall not exceed the fee limitations in FAR 15.404-4(c)(4)(i).

(i) The Contractor shall give the Contracting Officer immediate written notice of any action or suit filed and prompt notice of any claim made against the Contractor by any subcontractor or vendor that, in the opinion of the Contractor, may result in litigation related in any way to this contract, with respect to which the Contractor may be entitled to reimbursement by the Government.

(j) The Government reserves the right to review the Contractor's purchasing system as set forth in FAR Subpart 44.3.

(k) Paragraphs (d) and (f) of this clause do not apply to the following subcontracts, which ere evaluated during negotiations:

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(End of clause)

### **113. FAR 52.244-6 SUBCONTRACTS FOR COMMERCIAL ITEMS (MAY 2002)**

(a) *Definitions.* As used in this clause—

"Commercial item" has the meaning contained in the clause at 52.202-1, Definitions.

"Subcontract" includes a transfer of commercial items between divisions, subsidiaries, or affiliates of the Contractor or subcontractor at any tier.

(b) To the maximum extent practicable, the Contractor shall incorporate, and require its subcontractors at all tiers to incorporate, commercial items or nondevelopmental items as components of items to be supplied under this contract.

(c)(1) The Contractor shall insert the following clauses in subcontracts for commercial items:

(i) 52.219-8, Utilization of Small Business Concerns (Oct 2000) (15 U.S.C. 637(d)(2) and (3)), in all subcontracts that offer further subcontracting opportunities. If the subcontract (except subcontracts to small business concerns) exceeds \$500,000 (\$1,000,000 for construction of any public facility), the subcontractor must include 52.219-8 in lower tier subcontracts that offer subcontracting opportunities.

(ii) 52.222-26, Equal Opportunity (Apr 2002) (E.O. 11246).

(iii) 52.222-35, Equal Opportunity for Special Disabled Veterans, Veterans of the Vietnam Era, and Other Eligible Veterans (Dec 2001) (38 U.S.C. 4212(a));

(iv) 52.222-36, Affirmative Action for Workers with Disabilities (June 1998) (29 U.S.C. 793).

(v) 52.247-64, Preference for Privately Owned U.S.-Flag Commercial Vessels (June 2000) (46 U.S.C. Appx 1241) (flowdown not required for subcontracts awarded beginning May 1, 1996).

(2) While not required, the Contractor may flow down to subcontracts for commercial items a minimal number of additional clauses necessary to satisfy its contractual obligations.

(d) The Contractor shall include the terms of this clause, including this paragraph (d), in subcontracts awarded under this contract.

(End of clause)

**114. \*FAR 52.245-2 GOVERNMENT PROPERTY (FIXED-PRICE CONTRACTS) (DEC 1989) [For Government Property over \$100,000]**

(a) Government-furnished property.

(1) The Government shall deliver to the Contractor, for use in connection with and under the terms of this contract, the Government-furnished property described in the Schedule or specifications together with any related data and information that the Contractor may request and is reasonably required for the intended use of the property (hereinafter referred to as "Government-furnished property").

(2) The delivery or performance dates for this contract are based upon the expectation that Government-furnished property suitable for use (except for property furnished "as is") will be delivered to the Contractor at the times stated in the Schedule or, if not so stated, in sufficient time to enable the Contractor to meet the contract's delivery or performance dates.

(3) If Government-furnished property is received by the Contractor in a condition not suitable for the intended use, the Contractor shall, upon receipt of it, notify the Contracting Officer, detailing the facts, and, as directed by the Contracting Officer and at Government expense, either repair, modify, return, or otherwise dispose of the property. After completing the directed action and upon written request of the Contractor, the Contracting Officer shall make an equitable adjustment as provided in paragraph (h) of this clause.

(4) If Government-furnished property is not delivered to the Contractor by the required time, the Contracting Officer shall, upon the Contractor's timely written request, make a determination of the delay, if any, caused the Contractor and shall make an equitable adjustment in accordance with paragraph (h) of this clause.

(b) Changes in Government-furnished property.

(1) The Contracting Officer may, by written notice,

(i) decrease the Government-furnished property provided or to be provided under this contract, or

(ii) substitute other Government-furnished property for the property to be provided by the Government, or to be acquired by the Contractor for the Government, under this contract. The Contractor shall promptly take such action as the Contracting Officer may direct regarding the removal, shipment, or disposal of the property covered by such notice.

(2) Upon the Contractor's written request, the Contracting Officer shall make an equitable adjustment to the contract in accordance with paragraph (h) of this clause, if the Government has agreed in the Schedule to make the property available for performing this contract and there is any--

(i) Decrease or substitution in this property pursuant to subparagraph (b)(1) above;

or

(ii) Withdrawal of authority to use this property, if provided under any other contract or lease.

(c) Title in Government property.

(1) The Government shall retain title to all Government-furnished property.

(2) All Government-furnished property and all property acquired by the Contractor, title to which vests in the Government under this paragraph (collectively referred to as "Government property"), are subject to the provisions of this clause. However, special tooling accountable to this contract is subject to the provisions of the Special Tooling clause and is not subject to the provisions of this clause. Title to Government property shall not be affected by its incorporation into or attachment to any property not owned by the Government, nor shall government property become a fixture or lose its identity as personal property by being attached to any real property.

(3) Title to each item of facilities and special test equipment acquired by the Contractor for the Government under this contract shall pass to and vest in the Government when its use in performing this contract commences or when the Government has paid for it, whichever is earlier, whether or not title previously vested in the Government.

(4) If this contract contains a provision directing the Contractor to purchase material for which the Government will reimburse the Contractor as a direct item of cost under this contract--

(i) Title to material purchased from a vendor shall pass to and vest in the Government upon the vendor's delivery of such material; and

- (ii) Title to all other material shall pass to and vest in the Government upon--
- (A) Issuance of the material for use in contract performance;
  - (B) Commencement of processing of the material or its use in contract performance; or
  - (C) Reimbursement of the cost of the material by the Government, whichever occurs first.
- (d) Use of Government property. The Government property shall be used only for performing this contract, unless otherwise provided in this contract or approved by the Contracting Officer.
- (e) Property Administration.
- (1) The Contractor shall be responsible and accountable for all Government property provided under this contract and shall comply with Federal Acquisition Regulation (FAR) Subpart 45.5, as in effect on the date of this contract.
  - (2) The Contractor shall establish and maintain a program for the use, maintenance, repair, protection, and preservation of Government property in accordance with sound industrial practice and the applicable provisions of Subpart 45.5 of the FAR.
  - (3) If damage occurs to Government property, the risk of which has been assumed by the Government under this contract, the Government shall replace the items or the Contractor shall make such repairs as the Government directs. However, if the Contractor cannot effect such repairs within the time required, the Contractor shall dispose of the property as directed by the Contracting Officer. When any property for which the Government is responsible is replaced or repaired, the Contracting Officer shall make an equitable adjustment in accordance with paragraph (h) of this clause.
  - (4) The Contractor represents that the contract price does not include any amount for repairs or replacement for which the Government is responsible. Repair or replacement of property for which the Contractor is responsible shall be accomplished by the Contractor at its own expense.
- (f) Access. The Government and all its designees shall have access at all reasonable times to the premises in which any Government property is located for the purpose of inspecting the Government property.
- (g) Risk of loss. Unless otherwise provided in this contract, the Contractor assumes the risk of, and shall be responsible for, any loss or destruction of, or damage to, Government property upon its delivery to the Contractor or upon passage of title to the Government under paragraph (c) of this clause. However, the Contractor is not responsible for reasonable wear and tear to Government property or for Government property properly consumed in performing this contract.
- (h) Equitable adjustment. When this clause specifies an equitable adjustment, it shall be made to any affected contract provision in accordance with the procedures of the Changes clause. When appropriate, the Contracting Officer may initiate an equitable adjustment in favor of the Government. The right to an equitable adjustment shall be the Contractor's exclusive remedy. The Government shall not be liable to suit for breach of contract for--
- (1) Any delay in delivery of Government-furnished property;
  - (2) Delivery of Government-furnished property in a condition not suitable for its intended use;
  - (3) A decrease in or substitution of Government-furnished property; or
  - (4) Failure to repair or replace Government property for which the Government is responsible.
- (i) Final accounting and disposition of Government property. Upon completing this contract, or at such earlier dates as may be fixed by the Contracting Officer, the Contractor shall submit, in a form acceptable to the Contracting Officer, inventory schedules covering all items of Government property (including any resulting scrap) not consumed in performing this contract or delivered to the Government. The Contractor shall prepare for shipment, deliver f.o.b. origin, or dispose of the Government property as may be directed or authorized by the Contracting Officer. The net proceeds of any such disposal shall be credited to the contract price or shall be paid to the Government as the Contracting Officer directs.
- (j) Abandonment and restoration of Contractor's premises. Unless otherwise provided herein, the Government--
- (1) May abandon any Government property in place, at which time all obligations of the Government regarding such abandoned property shall cease; and
  - (2) Has no obligation to restore or rehabilitate the Contractor's premises under any circumstances (e.g., abandonment, disposition upon completion of need, or upon contract completion). However, if the Government-furnished property (listed in the Schedule or specifications) is withdrawn or is unsuitable for the

intended use, or if other Government property is substituted, then the equitable adjustment under paragraph (h) of this clause may properly include restoration or rehabilitation costs.

(k) Communications. All communications under this clause shall be in writing.

(l) Overseas contracts. If this contract is to be performed outside of the United States of America, its territories, or possessions, the words "Government" and "Government-furnished" (wherever they appear in this clause) shall be construed as "United States Government" and "United States Government-furnished," respectively.

**115. \*FAR 52.245-4 GOVERNMENT-FURNISHED PROPERTY (SHORT FORM) (APR 1984)**  
**[For Government Property \$100,000 or Less]**

(a) The Government shall delivery to the Contractor, at the time and locations stated in this contract, the Government-furnished property described in the Schedule or specifications. If that property, suitable for its intended use, is not delivered to the Contractor, the Contracting Officer shall equitably adjust affected provisions of this contract in accordance with the Changed clause when--

(1) The Contractor submits a timely written request for an equitable adjustment; and

(2) The facts warrant an equitable adjustment.

(b) Title to Government-furnished property shall remain in the Government. The Contractor shall use the Government-furnished property only in connection with this contract. The Contractor shall maintain adequate property control records in accordance with sound industrial practice and will make such records available for Government inspection at all reasonable times, unless the clause at Federal Acquisition Regulation 52.245-1, Property Records, is included in this contract.

(c) Upon delivery of Government-furnished property to the Contractor, the Contractor assumes the risk and responsibility for its loss or damage, except--

(1) For reasonable wear and tear;

(2) To the extent property is consumed in performing this contract; or

(3) As otherwise provided for by the provisions of this contract.

(d) Upon completing this contract, the Contractor shall follow the instructions of the Contracting Officer regarding the disposition of all Government-furnished property not consumed in performing this contract or previously delivered to the Government. The Contractor shall prepare for shipment, deliver f.o.b. origin, or dispose of the Government property, as may be directed or authorized by the Contracting Officer. The net proceeds of any such disposal shall be credited to the contract price or shall be paid to the Government as directed by the Contracting Officer.

(e) If this contract is to be performed outside the United States of America, its territories, or possessions, the words "Government" and "Government-furnished" (wherever they appear in this clause) shall be construed as "United States Government" and "United States Government-furnished," respectively.

**116. \*FAR 52.246-12 INSPECTION OF CONSTRUCTION (AUG 1996)**

(a) Definition. "Work" includes, but is not limited to, materials, workmanship, and manufacture and fabrication of components.

(b) The Contractor shall maintain an adequate inspection system and perform such inspections as will ensure that the work performed under the contract conforms to contract requirements. The Contractor shall maintain complete inspection records and make them available to the Government. All work shall be conducted under the general direction of the Contracting Officer and is subject to Government inspection and test at all places and at all reasonable times before acceptance to ensure strict compliance with the terms of the contract.

(c) Government inspections and tests are for the sole benefit of the Government and do not--

(1) Relieve the Contractor of responsibility for providing adequate quality control measures;

(2) Relieve the Contractor of responsibility for damage to or loss of the material before acceptance;

(3) Constitute or imply acceptance; or

(4) Affect the continuing rights of the Government after acceptance of the completed work under paragraph (i) below.

(d) The presence or absence of a Government inspector does not relieve the Contractor from any contract requirement, nor is the inspector authorized to change any term or condition of the specification without the Contracting Officer's written authorization.

(e) The Contractor shall promptly furnish, at no increase in contract price, all facilities, labor, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by the Contracting Officer. The Government may charge to the Contractor any additional cost of inspection or test when work is not ready at the time specified by the Contractor for inspection or test, or when prior rejection makes reinspection or retest necessary. The Government shall perform all inspections and tests in a manner that will not unnecessarily delay the work. Special, full size, and performance tests shall be performed as described in the contract.

(f) The Contractor shall, without charge, replace or correct work found by the Government not to conform to contract requirements, unless in the public interest the Government consents to accept the work with an appropriate adjustment in contract price. The Contractor shall promptly segregate and remove rejected material from the premises.

(g) If the Contractor does not promptly replace or correct rejected work, the Government may  
(1) by contract or otherwise, replace or correct the work and charge the cost to the Contractor  
or

(2) Terminate for default the Contractor's right to proceed.

(h) If, before acceptance of the entire work, the Government decides to examine already completed work by removing it or tearing it out, the Contractor, on request, shall promptly furnish all necessary facilities, labor, and material. If the work is found to be defective or nonconforming in any material respect due to the fault of the Contractor or its subcontractors, the Contractor shall defray the expenses of the examination and of satisfactory reconstruction. However, if the work is found to meet contract requirements, the Contracting Officer shall make an equitable adjustment for the additional services involved in the examination and reconstruction, including, if completion of the work was thereby delayed, an extension of time.

(i) Unless otherwise specified in the contract, the Government shall accept, as promptly as practicable after completion and inspection, all work required by the contract or that portion of the work the Contracting Officer determines can be accepted separately. Acceptance shall be final and conclusive except for latent defects, fraud, gross mistakes amounting to fraud, or the Government's rights under any warranty or guarantee.

#### **117. \*FAR 52.246-21 WARRANTY OF CONSTRUCTION (MAR 1994)**

(a) In addition to any other warranties in this contract, the Contractor warrants, except as provided in paragraph (i) of this clause, that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, or design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier.

(b) This warranty shall continue for a period of 1 year from the date of final acceptance of the work. If the Government takes possession of any part of the work before final acceptance, this warranty shall continue for a period of 1 year from the date the Government takes possession.

(c) The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Government-owned or controlled real or personal property, when that damage is the result of--

- (1) The Contractor's failure to conform to contract requirements; or
- (2) Any defect of equipment, material, workmanship, or design furnished.

(d) The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for 1 year from the date of repair or replacement.

(e) The Contracting Officer shall notify the Contractor, in writing, within a reasonable time after the discovery of any failure, defect, or damage.

(f) If the Contractor fails to remedy any failure, defect, or damage within a reasonable time after receipt of notice, the Government shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

(g) With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall--

(1) Obtain all warranties that would be given in normal commercial practice;

(2) Require all warranties to be executed, in writing, for the benefit of the Government, if directed by the Contracting Officer; and

(3) Enforce all warranties for the benefit of the Government, if directed by the Contracting Officer.

(h) In the event the Contractor's warranty under paragraph (b) of this clause has expired, the Government may bring suit at its expense to enforce a subcontractor's, manufacturer's, or supplier's warranty.

(i) Unless a defect is caused by the negligence of the Contractor or subcontractor or supplier at any tier, the Contractor shall not be liable for the repair of any defects of material or design furnished by the Government nor for the repair of any damage that results from any defect in Government-furnished material or design.

(j) This warranty shall not limit the Government's rights under the Inspection and Acceptance clause of this contract with respect to latent defects, gross mistakes, or fraud.

**118. DFARS 252.247-7023 TRANSPORTATION OF SUPPLIES BY SEA (MAR 2000)**

(a) Definitions.

As used in this clause--

(1) "Components" means articles, materials, and supplies incorporated directly into end products at any level of manufacture, fabrication, or assembly by the Contractor or any subcontractor.

(2) "Department of Defense" (DOD) means the Army, Navy, Air Force, Marine Corps, and defense agencies.

(3) "Foreign flag vessel" means any vessel that is not a U.S.-flag vessel.

(4) "Ocean transportation" means any transportation aboard a ship, vessel, boat, barge, or ferry through international waters.

(5) "Subcontractor" means a supplier, materialman, distributor, or vendor at any level below the prime Contractor whose contractual obligation to perform results from, or is conditioned upon, award of the prime contract and who is performing any part of the work or other requirement of the prime contract.

(6) "Supplies" means all property, except land and interests in land, that is clearly identifiable for eventual use by or owned by the DoD at the time of transportation by sea.

(i) An item is clearly identifiable for eventual use by the DoD if, for example, the contract documentation contains a reference to a DoD contract number or a military destination.

(ii) "Supplies" includes (but is not limited to) public works; buildings and facilities; ships; floating equipment and vessels of every character, type, and description, with parts, subassemblies, accessories, and equipment; machine tools; material; equipment; stores of all kinds; end items; construction materials; and components of the foregoing.

(7) "U.S.-flag vessel" means a vessel of the United States or belonging to the United States, including any vessel registered or having national status under the laws of the United States.

- (b) (1) The Contractor shall use U.S. -flag vessels when transporting any supplies by sea under this contract.
- (2) A subcontractor transporting supplies by sea under this contract shall use U.S.-flag vessel if--
- (i) This Contract is a construction contract; or
  - (ii) The supplies being transported are--
    - (A) Noncommercial items; or
    - (B) Commercial items that--
      - (1) The Contractor is reselling or distributing to the Government without adding value (generally, the Contractor does not add value to items that it subcontracts for f.o.b. destination shipment);
      - (2) Are shipped in direct support of U.S. military contingency operations, exercises, or forces deployed in humanitarian or peacekeeping operations; or
      - (3) Are commissary or exchange cargoes transported outside of the Defense Transportation System in accordance with 10 U.S.C. 2643.
- (c) The Contractor and its subcontractors may request that the Contracting Officer authorize shipment in foreign-flag vessels, or designate available U.S.-flag vessels, if the Contractor or a subcontractor believes that--
- (1) U.S.-flag vessels are not available for timely shipment;
  - (2) The freight charges are inordinately excessive or unreasonable; or
  - (3) Freight charges are higher than charges to private persons for transportation of like goods.
- (d) The Contractor must submit any request for use of other than U.S.-flag vessels in writing to the Contracting Officer at least 45 days prior to the sailing date necessary to meet its delivery schedules. The Contracting Officer will process requests submitted after such date(s) as expeditiously as possible, but the Contracting Officer's failure to grant approvals to meet the shipper's sailing date will not of itself constitute a compensable delay under this or any other clause of this contract. Requests shall contain at a minimum--
- (1) Type, weight, and cube of cargo;
  - (2) Required shipping date;
  - (3) Special handling and discharge requirements;
  - (4) Loading and discharge points;
  - (5) Name of shipper and consignee;
  - (6) Prime contract number, and
  - (7) A documented description of efforts made to secure U.S.-flag vessels, including points of contact (with names and telephone numbers) with at least two U.S.-flag carriers contacted. Copies of telephone notes, telegraphic and facsimile message or letters will be sufficient for this purpose.
- (e) The Contractor shall, within 30 days after each shipment covered by this clause, provide the Contracting Officer and the Division of National Cargo, Office of Market Development, Maritime Administration, U.S. Department of Transportation, Washington, DC 20590, one copy of the rated on board vessel operating carrier's ocean bill of lading, which shall contain the following information--
- (1) Prime contract number;
  - (2) Name of vessel;
  - (3) Vessel flag of registry;
  - (4) Date of loading;
  - (5) Port of loading;
  - (6) Port of final discharge;
  - (7) Description of commodity;
  - (8) Gross weight in pounds and cubic feet if available;
  - (9) Total ocean freight in U.S. dollars; and
  - (10) Name of the steamship company.
- (f) The Contractor agrees to provide with its final invoice under this contract a representation that to the best of its knowledge and belief--
- (1) No ocean transportation was used in the performance of this contract;
  - (2) Ocean transportation was used and only U.S.-flag vessels were used for all ocean shipments under the contract;

(3) Ocean transportation was used, and the Contractor had the written consent of the Contracting Officer for all non-U.S.-flag ocean transportation; or

(4) Ocean transportation was used and some or all of the shipments were made on non-U.S.-flag vessels without the written consent of the Contracting Officer. The Contractor shall describe these shipments in the following format;

ITEM DESCRIPTION	CONTRACT LINE ITEMS	QUANTITY
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TOTAL

(g) If the final invoice does not include the required representation, the Government will reject and return it to the Contractor as an improper invoice for the purposes of the Prompt Payment clause of this contract. In the event there has been unauthorized use of non-U.S.-flag vessels in the performance of this contract, the Contracting Officer is entitled to equitably adjust the contract, based on the unauthorized use.

(h) The Contractor shall include this clause, including this paragraph (h) in all subcontracts under this contract that-

- (1) Exceed the simplified acquisition threshold in Part 2 of the Federal Acquisition Regulation; and
- (2) Are for a type of supplies described in paragraph (b) (2) of this clause.

**119. DFARS 252.247-7024 NOTIFICATION OF TRANSPORTATION OF SUPPLIES BY SEA (MAR 2000)**

(a) The Contractor has indicated by the response to the solicitation provision, Representation of Extent of Transportation by Sea, that it did not anticipate transporting by sea any supplies. If, however, after the award of this contract, the Contractor learns that supplies, as defined in the Transportation of Supplies by Sea clause of this contract, will be transported by sea, the Contractor--

- (1) Shall notify the Contracting Officer of that fact; and
- (2) Hereby agrees to comply with all the terms and conditions of the Transportation of

Supplies by Sea clause of this contract.

(b) (1) The Contractor shall use U.S. -flag vessels when transporting any supplies by sea under this contract.

- (2) A subcontractor transporting supplies by sea under this contract shall use U.S.-flag vessel if--
  - (i) This Contract is a construction contract; or
  - (ii) The supplies being transported are--
    - (A) Noncommercial items; or
    - (B) Commercial items that--
      - (1) The Contractor is reselling or distributing to the Government without adding value (generally, the Contractor does not add value to items that it subcontracts for f.o.b. destination shipment);
      - (2) Are shipped in direct support of U.S. military contingency operations, exercises, or forces deployed in humanitarian or peacekeeping operations; or
      - (3) Are commissary or exchange cargoes transported outside of the Defense Transportation System in accordance with 10 U.S.C. 2643.

**120. FAR 52.248-3 VALUE ENGINEERING--CONSTRUCTION (FEB 2000) (ALTERNATE I (APR 1984))**

(a) General. The Contractor is encouraged to develop, prepare, and submit value engineering change proposals (VECP's) voluntarily. The Contractor shall share in any instant contract savings realized from accepted VECP's, in accordance with paragraph (f) of this clause.

(b) Definitions. "Collateral costs," as used in this clause, means agency costs of operation, maintenance, logistic support, or Government-furnished property.

"Collateral savings," as used in this clause, means those measurable net reductions resulting from a VECP in the agency's overall projected collateral costs, exclusive of acquisition savings, whether or not the acquisition cost changes.

"Contractor's development and implementation costs," as used in this clause, means those costs the Contractor incurs on a VECP specifically in developing, testing, preparing, and submitting the VECP, as well as those costs the Contractor incurs to make the contractual changes required by Government acceptance of a VECP.

"Government costs," as used in this clause, means those agency costs that result directly from developing and implementing the VECP, such as any net increases in the cost of testing, operations, maintenance, and logistic support. The term does not include the normal administrative costs of processing the VECP.

"Instant contract savings," as used in this clause, means the estimated reduction in Contractor cost of performance resulting from acceptance of the VECP, minus allowable Contractor's development and implementation costs, including subcontractors' development and implementation costs (see paragraph (h) of this clause).

"Value engineering change proposal (VECP)" means a proposal that--

- (1) Requires a change to this, the instant contract, to implement; and
- (2) Results in reducing the contract price or estimated cost without impairing essential functions or characteristics; provided, that it does not involve a change--
  - (i) In deliverable end item quantities only; or
  - (ii) To the contract type only.

(c) VECP preparation. As a minimum, the Contractor shall include in each VECP the information described in paragraphs (c) (1) through (7) of this clause. If the proposed change is affected by contractually required configuration management or similar procedures, the instructions in those procedures relating to format, identification, and priority assignment shall govern VECP preparation. The VECP shall include the following:

- (1) A description of the difference between the existing contract requirement and that proposed, the comparative advantages and disadvantages of each, a justification when an item's function or characteristics are being altered, and the effect of the change on the end item's performance.
- (2) A list and analysis of the contract requirements that must be changed if the VECP is accepted, including any suggested specification revisions.
- (3) A separate, detailed cost estimate for
  - (i) the affected portions of the existing contract requirement and
  - (ii) the VECP. The cost reduction associated with the VECP shall take into account the Contractor's allowable development and implementation costs, including any amount attributable to subcontracts under paragraph (h) of this clause.
- (4) A description and estimate of costs the Government may incur in implementing the VECP, such as test and evaluation and operating and support costs.
- (5) A prediction of any effects the proposed change would have on collateral costs to the agency.
- (6) A statement of the time by which a contract modification accepting the VECP must be issued in order to achieve the maximum cost reduction, noting any effect on the contract completion time or delivery schedule.
- (7) Identification of any previous submissions of the VECP, including the dates submitted, the agencies and contract numbers involved, and previous Government actions, if known.

(d) Submission. The Contractor shall submit VECP's to the Resident Engineer at the worksite, with a copy to the Contracting Officer.

(e) Government action.

(1) The Contracting Officer will notify the Contractor of the status of the VECP within 45 calendar days after the contracting office receives it. If additional time is required, the Contracting Officer will notify the Contractor within the 45-day period and provide the reason for the delay and the expected date of the

decision. The Government will process VECP's expeditiously; however, it will not be liable for any delay in acting upon a VECP.

(2) If the VECP is not accepted, the Contracting Officer will notify the Contractor in writing, explaining the reasons for rejection. The Contractor may withdraw any VECP, in whole or in part, at any time before it is accepted by the Government. The Contracting Officer may require that the Contractor provide written notification before undertaking significant expenditures for VECP effort.

(3) Any VECP may be accepted, in whole or in part, by the Contracting Officer's award of a modification to this contract citing this clause. The Contracting Officer may accept the VECP, even though an agreement on price reduction has not been reached, by issuing the Contractor a notice to proceed with the change. Until a notice to proceed is issued or a contract modification applied a VECP to this contract, the Contractor shall perform in accordance with the existing contract. The decision to accept or reject all or part of any VECP is a unilateral decision made solely at the discretion of the Contracting Officer.

(f) Sharing.

(1) Rates. The Government's share of savings is determined by subtracting Government costs from instant contract savings and multiplying the result by

- (i) 45 percent for fixed-price contracts or
- (ii) 75 percent for cost-reimbursement contracts.

(2) Payment. Payment of any share due the Contractor for use of a VECP on this contract shall be authorized by a modification to this contract to--

- (i) Accept the VECP;
- (ii) Reduce the contract price or estimated cost by the amount of instant contract savings; and
- (iii) Provide the Contractor's share of savings by adding the amount calculated to the contract price or fee.

(g) Deleted.

(h) Subcontracts. The Contractor shall include an appropriate value engineering clause in any subcontract of \$50,000 or more and may include one in subcontracts of lesser value. In computing any adjustment in this contract's price under paragraph (f) of this clause, the Contractor's allowable development and implementation costs clearly resulting from a VECP accepted by the Government under this contract, but shall exclude any value engineering incentive payments to a subcontractor. The Contractor may choose any arrangement for subcontractor value engineering incentive payments; provided, that these payments shall not reduce the Government's share of the savings resulting from the VECP.

(i) Data. The Contractor may restrict the Government's right to use any part of a VECP or the supporting data by marking the following legend on the affected parts:

"These data, furnished under the Value Engineering--Construction clause of contract - \_\_\_\_\_, shall not be disclosed outside the Government or duplicated, used, or disclosed, in whole or in part, for any purpose other than to evaluate a value engineering change proposal submitted under the clause. This restriction does not limit the Government's right to use information contained in these data if it has been obtained or is otherwise available from the Contractor or from another source without limitations."

If a VECP is accepted, the Contractor hereby grants the Government unlimited rights in the VECP and supporting data, except that, with respect to data qualifying and submitted as limited rights technical data, the Government shall have the rights specified in the contract modification implementing the VECP and shall appropriately mark the data. (The terms "unlimited rights" and "limited rights" are defined in Part 27 of the Federal Acquisition Regulation.)

(End of Clause)

**121. \*FAR 52.249-1 TERMINATION FOR CONVENIENCE OF THE GOVERNMENT (FIXED-PRICE) (SHORT FORM) (APR 1984) [For Contracts \$100,000 or Less]**

The Contracting Officer, by written notice, may terminate this contract, in whole or in part, when it is in the Government's interest. If this contract is terminated, the rights, duties, and obligations of the parties, including

compensation to the Contractor, shall be in accordance with Part 49 of the Federal Acquisition Regulation in effect on the date of this contract.

**122. \*FAR 52.249-2 TERMINATION FOR CONVENIENCE OF THE GOVERNMENT (FIXED-PRICE) ALTERNATE I (SEP 1996) [For Contracts Over \$100,000]**

(a) The Government may terminate performance of work under this contract in whole or, from time to time, in part if the Contracting Officer determines that a termination is in the Government's interest. The Contracting Officer shall terminate by delivering to the Contractor a Notice of Termination specifying the extent of termination and the effective date.

(b) After receipt of a Notice of Termination, and except as directed by the Contracting Officer, the Contractor shall immediately proceed with the following obligations, regardless of any delay in determining or adjusting any amounts due under this clause:

- (1) Stop work as specified in the notice.
- (2) Place no further subcontracts or orders (referred to as subcontracts in this clause) for materials, services, or facilities, except as necessary to complete the continued portion of the contract.
- (3) Terminate all subcontracts to the extent they relate to the work terminated.
- (4) Assign to the Government, as directed by the Contracting Officer, all right, title, and interest of the Contractor under the subcontracts terminated, in which case the Government shall have the right to settle or to pay any termination settlement proposal arising out of those terminations.
- (5) With approval or ratification to the extent required by the Contracting Officer, settle all outstanding liabilities and termination settlement proposals arising from the termination of subcontracts; the approval or ratification will be final for purposes of this clause.
- (6) As directed by the Contracting Officer, transfer title and deliver to the Government
  - (i) the fabricated or unfabricated parts, work in process, completed work, supplies, and other material produced or acquired for the work terminated, and
  - (ii) the completed or partially completed plans, drawings, information, and other property that, if the contract had been completed, would be required to be furnished to the Government.
- (7) Complete performance of the work not terminated.
- (8) Take any action that may be necessary, or that the Contracting Officer may direct, for the protection and preservation of the property related to this contract that is in the possession of the Contractor and in which the Government has or may acquire an interest.
- (9) Use its best efforts to sell, as directed or authorized by the Contracting Officer, any property of the types referred to in subparagraph (b) (6) of this clause; provided, however, that the Contractor
  - (i) is not required to extend credit to any purchaser and
  - (ii) may acquire the property under the conditions prescribed by, and at prices approved by, the Contracting Officer. The proceeds of any transfer or disposition will be applied to reduce any payments to be made by the Government under this contract, credited to the price or cost of the work, or paid in any other manner directed by the Contracting Officer.

(c) The Contractor shall submit complete termination inventory schedules no later than 120 days from the effective date of termination, unless extended in writing by the Contracting Officer upon written request of the Contractor within this 120-day period.

(d) After expiration of the plant clearance period as defined in Subpart 45.6 of the Federal Acquisition Regulation, the Contractor may submit to the Contracting Officer a list, certified as to quantity and quality, of termination inventory not previously disposed of, excluding items authorized for disposition by the Contracting Officer. The Contractor may request the Government to remove those items or enter into an agreement for their storage. Within 15 days, the Government will accept title to those items and remove them or enter into a storage agreement. The Contracting Officer may verify the list upon removal of the items, or if stored, within 45 days from submission of the list, and shall correct the list, as necessary, before final settlement.

(e) After termination, the Contractor shall submit a final termination settlement proposal to the Contracting Officer in the form and with the certification prescribed by the Contracting Officer. The Contractor shall submit the proposal promptly, but no later than 1 year from the effective date of termination, unless extended in writing by the Contracting Officer upon written request of the Contractor within this 1 year period. However, if the Contracting Officer determines that the facts justify it, a termination settlement proposal may be received and

acted on after 1 year or any extension. If the Contractor fails to submit the proposal within the time allowed, the Contracting Officer may determine, on the basis of information available, the amount, if any, due the Contractor because of the termination and shall pay the amount determined.

(f) Subject to paragraph (e) of this clause, the Contractor and the Contracting Officer may agree upon the whole or any part of the amount to be paid because of the termination. The amount may include a reasonable allowance for profit on work done. However, the agreed amount, whether under this paragraph (f) or paragraph (g) of this clause, exclusive of costs shown in subparagraph (g)(3) of this clause, may not exceed the total contract price as reduced by (1) the amount of payments previously made and (2) the contract price of work not terminated. The contract shall be amended, and the Contractor paid the agreed amount. Paragraph (f) of this clause shall not limit, restrict, or affect the amount that may be agreed upon to be paid under this paragraph.

(g) If the Contractor and the Contracting Officer fail to agree on the whole amount to be paid the Contractor because of the termination of work, the Contracting Officer shall pay the Contractor the amounts determined as follows, but without duplication of any amounts agreed upon under paragraph (f) of this clause:

(1) For contract work performed before the effective date of the termination, the total (without duplication of any items) of--

(i) The cost of this work;

(ii) The cost of settling and paying termination settlement proposals under terminated subcontracts that are properly chargeable to the terminated portion of the contract if not included in subdivision (g)(1)(i) of this clause; and

(iii) A sum, as profit on subdivision (g)(1)(i) of this clause, determined by the Contracting Officer under 49.202 of the Federal Acquisition Regulation, in effect on the date of this contract, to be fair and reasonable; however, if it appears that the Contractor would have sustained a loss on the entire contract had it been completed, the Contracting Officer shall allow no profit under this subdivision (iii) and shall reduce the settlement to reflect the indicated rate of loss.

(2) The reasonable costs of settlement of the work terminated, including--

(i) Accounting, legal, clerical, and other expenses reasonably necessary for the preparation of termination settlement proposals and supporting data;

(ii) The termination and settlement of subcontracts (excluding the amounts of such settlements); and

(iii) Storage, transportation, and other costs incurred, reasonably necessary for the preservation, protection, or disposition of the termination inventory.

(h) Except for normal spoilage, and except to the extent that the Government expressly assumed the risk of loss, the Contracting Officer shall exclude from the amounts payable to the Contractor under paragraph (g) of this clause, the fair value, as determined by the Contracting Officer, of property that is destroyed, lost, stolen, or damaged so as to become undeliverable to the Government or to a buyer.

(i) The cost principles and procedures of Part 31 of the Federal Acquisition Regulation, in effect on the date of this contract, shall govern all costs claimed, agreed to, or determined under this clause.

(j) The Contractor shall have the right of appeal, under the Disputes clause, from any determination made by the Contracting Officer under paragraph (e), (g), or (l) of this clause, except that if the Contractor failed to submit the termination settlement proposal within the time provided in paragraph (e) or (l), respectively, and failed to request a time extension, there is no right of appeal.

(k) In arriving at the amount due the Contractor under this clause, there shall be deducted--

(1) All unliquidated advance or other payments to the Contractor under the terminated portion of this contract;

(2) Any claim which the Government has against the Contractor under this contract; and

(3) The agreed price for, or the proceeds of sale of, materials, supplies, or other things acquired by the Contractor or sold under the provisions of this clause and not recovered by or credited to the Government.

(l) If the termination is partial, the Contractor may file a proposal with the Contracting Officer for an equitable adjustment of the price(s) of the continued portion of the contract. The Contracting Officer shall make any equitable adjustment agreed upon. Any proposal by the Contractor for an equitable adjustment under this clause shall be requested within 90 days from the effective date of termination unless extended in writing by the Contracting Officer.

(m) (1) The Government may, under the terms and conditions it prescribes, make partial payments and payments against costs incurred by the Contractor for the terminated portion of the contract, if the Contracting Officer believes the total of these payments will not exceed the amount to which the Contractor will be entitled.

(2) If the total payments exceed the amount finally determined to be due, the Contractor shall repay the excess to the Government upon demand, together with interest computed at the rate established by the Secretary of the Treasury under 50 U.S.C. App. 1215(b)(2). Interest shall be computed for the period from the date the excess payment is received by the Contractor to the date the excess is repaid. Interest shall not be charged on any excess payment due to a reduction in the Contractor's termination settlement proposal because of retention or other disposition of termination inventory until 10 days after the date of the retention or disposition, or a later date determined by the Contracting Officer because of the circumstances.

(n) Unless otherwise provided in this contract or by statute, the Contractor shall maintain all records and documents relating to the terminated portion of this contract for 3 years after final settlement. This includes all books and other evidence bearing on the Contractor's costs and expenses under this contract. The Contractor shall make these records and documents available to the Government, at the Contractor's office, at all reasonable times, without any direct charge. If approved by the Contracting Officer, photographs, microphotographs, or other authentic reproductions may be maintained instead of original records and documents.

**123. \*FAR 52.249-10 DEFAULT (FIXED-PRICE CONSTRUCTION) (APR 1984)**

(a) If the Contractor refuses or fails to prosecute the work or any separable part, with the diligence that will insure its completion within the time specified in this contract including any extension, or fails to complete the work within this time, the Government may, by written notice to the Contractor, terminate the right to proceed with the work (or the separable part of the work) that has been delayed. In this event, the Government may take over the work and complete it by contract or otherwise, and may take possession of and use any materials, appliances, and plant on the work site necessary for completing the work. The Contractor and its sureties shall be liable for any damage to the Government resulting from the Contractor's refusal or failure to complete the work within the specified time, whether or not the Contractor's right to proceed with the work is terminated. This liability includes any increased costs incurred by the Government in completing the work.

(b) The Contractor's right to proceed shall not be terminated nor the Contractor charged with damages under this clause, if-

(1) The delay in completing the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor. Examples of such causes include

- (i) acts of God or of the public enemy,
- (ii) acts of the Government in either its sovereign or contractual capacity,
- (iii) acts of another Contractor in the performance of a contract with the

Government,

- (iv) fires,
- (v) floods,
- (vi) epidemics,
- (vii) quarantine restrictions,
- (viii) strikes,
- (ix) freight embargoes,
- (x) unusually severe weather, or
- (xi) delays of subcontractors or suppliers at any tier arising from unforeseeable

causes beyond the control and without the fault or negligence of both the Contractor and the subcontractors or suppliers; and

(2) The Contractor, within 10 days from the beginning of any delay (unless extended by the Contracting Officer), notifies the Contracting Officer in writing of the causes of delay. The Contracting Officer shall ascertain the facts and the extent of delay. If, in the judgment of the Contracting Officer, the findings of fact warrant such action, the time for completing the work shall be extended. The findings of the Contracting Officer shall be final and conclusive on the parties, but subject to appeal under the Disputes clause.

(c) If, after termination of the Contractor's right to proceed, it is determined that the Contractor was not in default, or that the delay was excusable, the rights and obligations of the parties will be the same as if the termination had been issued for the convenience of the Government.

(d) The rights and remedies of the Government in this clause are in addition to any other rights and remedies provided by law or under this contract.

#### **124. ENVIRONMENTAL LITIGATION (1974 NOV OCE)**

(a) If the performance of all or any part of the work is suspended, delayed, or interrupted due to an order of a court of competent jurisdiction as a result of environmental litigation, as defined below, the Contracting Officer, at the request of the Contractor, shall determine whether the order is due in any part to the acts or omissions of the Contractor or a Subcontractor at any tier not required by the terms of this contract. If it is determined that the order is not due in any part to acts or omissions of the Contractor or a Subcontractor at any tier other than as required by the terms of this contract, such suspension, delay, or interruption shall be considered as if ordered by the Contracting Officer in the administration of this contract under the terms of the "Suspension of Work" clause of this contract. The period of such suspension, delay, or interruption shall be considered unreasonable, and an adjustment shall be made for any increase in the cost of performance of this contract (excluding profit) as provided in that clause, subject to all the provisions thereof.

(b) The term "environmental litigation," as used herein, means a lawsuit alleging that the work will have an adverse effect on the environment or that the Government has not duly considered, either substantively or procedurally, the effect of the work on the environment.

#### **125. EFARS 52.249-5000 BASIS FOR SETTLEMENT OF PROPOSALS**

Actual costs will be used to determine equipment cost for a settlement proposal submitted on the total cost basis under FAR 49.206-2(b). In evaluating a termination settlement proposal using the total cost basis, the following principles will be applied to determine allowable equipment costs:

(1) Actual costs for each piece of equipment, or groups of similar serial or series equipment, need not be available in the contractor's accounting records to determine total actual equipment costs.

(2) If equipment costs have been allocated to a contract using predetermined rates, those charges will be adjusted to actual costs.

(3) Recorded job costs adjusted for unallowable and unallocable expenses will be used to determine equipment operating expenses.

(4) Ownership costs (depreciation) will be determined using the contractor's depreciation schedule (subject to the provisions of FAR 31.205-11).

(5) License, taxes, storage and insurance costs are normally recovered as an indirect expense and unless the contractor charges these costs directly to contracts, they will be recovered through the indirect expense rate.

#### **126. INAPPLICABLE PROVISIONS AND CLAUSES (Local Provision). [Applicable only for projects or delivery orders less than \$100,000]**

This provision applies only to delivery orders and projects less than \$100,000.

Pursuant to Pub. L. 103-355, the following provisions and clauses, as noted below, are inapplicable to this contract:

- (a) FAR 28.102-3, Miller Act requirements;
- (b) Not Used;
- (c) FAR 52.203-5, Covenant Against Contingent Fees;
- (d) FAR 52.203-6, Restrictions on Subcontractor Sales to the Government;
- (e) FAR 52.203-7, Anti-Kickback Procedures;

- (f) FAR 52.222-4, Contract Work Hours and Safety Standards Act-Overtime Compensation; and
- (g) FAR 52.223-6, Drug-Free Workplace, except for individuals.

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5/00, Rev 11/02

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## SECTION 00800

SPECIAL CONTRACT REQUIREMENTS  
5/00, Rev 11/02

## PART 1 GENERAL

## Attachments:

General Wage Decision Nos. MT020001 & MT020003  
Appendix A Contract Document Distribution List

## 1.1 COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK (APR 1984)

The Contractor shall commence work under this contract within ten (10) calendar days after the date of receipt by him of Notice to Proceed, prosecute said work diligently, and complete the entire work except seeding ready for use not later than 730 calendar days after receipt of Notice to Proceed. The time stated for completion shall include final cleanup of the premises. (FAR 52.211-10)

## 1.1.1 Start Work

Evidence that the Contractor has started procurement of materials, preparation and submission of shop drawings, preparation of subcontracts, and other preparatory work will satisfy the requirement that work commence within ten (10) calendar days after receipt of Notice to Proceed. Therefore, work need not be commenced at the construction site within ten (10) calendar days.

## 1.1.2 Purchasing of Electronic Equipment

Due to the advances in electronic equipment, \$5000 has been set aside for purchasing electronic equipment as set out in Section 10100A. At the time of installation of this equipment, the Contractor is to purchase the most advanced equipment available at that time, to be installed into the Hatchery, up to \$5000. The total (\$5000) for this equipment has been entered as the contract lump sum price on the Bidding Schedule. The equipment list with equipment features listed along with all costs, including installation, shall be furnished to the Contracting Officer, for approval prior to purchasing. Payment for "Electronic Equipment", will be on a progressive basis, for each unit, based on the approved cost, acceptably installed according to the Manufacturer's recommendations and specifications. (See the Bid Scheudle, page 00010-3)

## 1.2 LIQUIDATED DAMAGES-CONSTRUCTION (SEPT 2000)

(a) If the Contractor fails to complete the work within the time specified in the contract , the Contractor shall pay liquidated damages to the Government in the amount of \$1200 for each calendar day of delay until the work is completed or accepted.

(b) If the Government terminates the Contractor's right to proceed, liquidated damages will continue to accrue until the work is completed. These liquidated damages are in addition to excess costs of repurchase under the Termination clause. (FAR 52.211-12)

### 1.3 EXCEPTION TO COMPLETION TIME AND LIQUIDATED DAMAGES

In case the Contracting Officer determines that seeding, and/or the specified maintenance thereof is not feasible during the construction period, such work will be excepted from the completion time and liquidated damages. This work shall be accomplished during the first seeding, period and the specified maintenance period following the completion date.

### 1.4 COMPUTING COMPLETION DATES FOR NON-WORK PERIOD

No work will be required at the construction site during the period 15 November 2003 through 15 April 2004 inclusive. The days in this period have been included in computing the calendar days for completion of the work. The Contractor may perform work at the site during all or any part of this period upon giving prior written notice to the Contracting Officer. Working during this non-work period shall require approval by the Contracting Officer. No time extensions will be granted for delays during this period.

### 1.5 CONTRACT DRAWINGS AND SPECIFICATIONS

#### 1.5.1 SETS FURNISHED

The contractor shall be responsible for making copies of specifications including amendments. The bid drawings as amended shall be utilized in the performance of the work until contract drawings (i.e., bid drawings that have been posted with all amendment changes) are mailed to the Contractor. See Section 01040 As-Built Drawings for drawings being furnished to the Contractor. The work shall conform to the contract drawings, set out in the drawing index, all of which form a part of these specifications. The work shall also conform to the standard details bound or referenced herein.

#### 1.5.2 DRAWING REPRODUCTION AND DISTRIBUTION

The contractor shall reproduce multiple hard copy sets of contract drawings from Government provided CD-ROM containing read-only cal file drawings. Within 21 calendar days from receipt of CD-ROM, Contractor shall forward reproduced documents to addresses contained in the Contract Document Distribution List for Project in Appendix A to this specification. No progress payments will be processed prior to receipt of the contract drawings by the Area Office. After receipt of documents, the Area Office shall provide the Contractor with a CD-ROM containing editable CAD file drawings. The Contractor shall edit CD-ROM containing CAD files drawings to prepare as-built drawings.

#### 1.5.3 NOTIFICATION OF DISCREPANCIES

The Contractor shall check all drawings furnished him immediately upon their receipt and shall promptly notify the Contracting Officer of any discrepancies. Dimensions marked on drawings shall be followed in lieu of scale measurements. Enlarged plans and details shall govern where the same work is shown at smaller scales. All scales shown are based on a standard drawing size of 28" x 40". If any other size drawings are furnished or plotted the contractor shall adjust the scales accordingly. The Contractor shall also advise his sub-contractors of the above. The Contractor shall compare all drawings and verify the figures before laying out the work and will be responsible for any errors which might have been avoided thereby.

#### 1.5.4 OMISSIONS

Omissions from the drawings or specifications or the misdescription of details of work which are manifestly necessary to carry out the intent of the drawings and specifications, or which are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work but they shall be performed as if fully and correctly set forth and described in the drawings and specifications.

#### 1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Equipment Room Drawings; G-AO.

Plant Layout Drawings; G-AO.

#### 1.7 PHYSICAL DATA (APR 1984)

Data and information furnished or referred to below is for the Contractors' information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.

a. The indications of physical conditions on the drawings and in the specifications are the result of site investigations by surveys and borings. The data shown graphically and by symbol for each respective boring represents the actual geologic features observed and logged at the location given on the drawings. While the borings are representative of subsurface conditions at their respective locations and for their respective vertical reaches, local minor variations characteristic of the subsurface materials of this region could occur.

b. Weather conditions shall have been investigated by the Contractor to satisfy himself as to the hazards likely to arise therefrom. Complete weather records and reports may be obtained from the local U.S. Weather Bureau.

c. Transportation facilities shall have been investigated by the Contractor to satisfy himself as to the existence of access highways and railroad facilities. (FAR 52.236-4)

#### 1.8 PAYMENT

##### 1.8.1 PROMPT PAYMENT ACT

Pay requests authorized in CONTRACT CLAUSES clause: "Payments Under Fixed-Price Construction Contracts", will be paid pursuant to the clause, "Prompt Payment for Construction Contracts". Pay requests will be submitted on ENG Form 93 and 93a, "Payment Estimate-Contract Performance" and "Continuation". All information and substantiation required by the identified contract clauses will be submitted with the ENG Form 93, and the required certification will be included on the last page of the ENG Form

93a, signed by an authorized contractor official and dated when signed. The designated billing office is the Office of the Area Engineer.

#### 1.8.2 PAYMENTS FOR MODIFICATIONS

Payments may be made for cost bearing change orders within the scope of the contract only to the extent funds are authorized in the order on a two-part modification. Contractor pricing proposed must be submitted at the earliest possible time after the change order is issued, or at a specific time as directed by the Contracting Officer. At the discretion of the Contracting Officer, any and all payments may be withheld on the modification until the Contractor has submitted a qualifying price proposal, in as much detail as required by the Contracting Officer, and the final price has been agreed.

#### 1.8.3 PAYMENT FOR MATERIALS DELIVERED OFFSITE (MAR 1995)

a. Pursuant to FAR clause 52.232-5, Payments Under Fixed Priced Construction Contracts, materials delivered to the contractor at locations other than the site of the work may be taken into consideration in making payments if included in payment estimates and if all the conditions of the General Provisions are fulfilled. Payment for items delivered to locations other than the work site will be limited to: (1) materials required by the technical provisions; or (2) materials that have been fabricated to the point where they are identifiable to an item of work required under this contract.

b. Such payment will be made only after receipt of paid or receipted invoices or invoices with canceled check showing title to the items in the prime contractor and including the value of material and labor incorporated into the item. Payment for materials delivered off-site includes petroleum products. (List additional items for which payments will be made for off-site delivery.) (EFAR 52.232-5000)

#### 1.9 DAMAGE TO WORK

The responsibility for damage to any part of the permanent work shall be as set forth in the CONTRACT CLAUSES clause: "Permits and Responsibilities." However, if, in the judgment of the Contracting Officer, any part of the permanent work performed by the Contractor is damaged by flood or earthquake, which damage is not due to the failure of the Contractor to take reasonable precautions or to exercise sound engineering and construction practices in the conduct of the work, the Contractor will make the repairs as ordered by the Contracting Officer and full compensation for such repairs will be made at the applicable contract unit or lump sum prices as fixed and established in the contract. If, in the opinion of the Contracting Officer, there are no contract unit or lump sum prices applicable to any part of such work an equitable adjustment pursuant to CONTRACT CLAUSES clause: "Changes," of the contract will be made as full compensation for the repairs of that part of the permanent work for which there are no applicable contract unit or lump sum prices. Except as herein provided, damage to all work (including temporary construction), utilities, materials, equipment and plant shall be repaired to the satisfaction of the Contracting Officer at the Contractor's expense, regardless of the cause of such damage.

#### 1.10 AVAILABILITY AND USE OF UTILITY SERVICES

Use of public and private utilities will be as found available. The

Contractor shall make his own arrangements for use of public and private utilities.

1.11 TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER

a. This clause specifies the procedure for the determination of time extensions for unusually severe weather in accordance with the contract clause entitled "Default: (Fixed-Price Construction)." In order for the Contracting Officer to award a time extension under this clause, the following conditions must be satisfied:

(1) The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.

(2) The unusually severe weather must actually cause a delay to the completion of the project. The delay must be beyond the control and without the fault or negligence of the contractor.

b. The following schedule of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the base line for monthly weather time evaluations. The contractor's progress schedule must reflect these anticipated adverse weather delays in all weather dependent activities.

MONTHLY ANTICIPATED ADVERSE WEATHER DELAY  
WORK DAYS BASED ON (5) DAY WORK WEEK

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
(*)	(18)	(10)	(02)	(03)	(06)	(03)	(03)	(01)	(01)	(09)	(20)

\* Anticipate losing entire month to adverse weather.

c. Upon acknowledgment of the Notice to Proceed (NTP) and continuing throughout the contract, the contractor will record on the daily CQC report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on critical activities for 50 percent or more of the contractor's scheduled work day. The number of actual adverse weather delay days shall include days impacted by actual adverse weather (even if adverse weather occurred in previous month), be calculated chronologically from the first to the last day of each month, and be recorded as full days. If the number of actual adverse weather delay days exceeds the number of days anticipated in paragraph b. above, the contracting officer will convert any qualifying delays to calendar days, giving full consideration for equivalent fair weather work days, and issue a modification in accordance with the contract clause entitled "Default (Fixed Price Construction)". (ER 415-1-15)

1.12 INSURANCE REQUIRED

In accordance with CONTRACT CLAUSES clause: "Insurance Work on a Government Installation," the Contractor shall procure the following minimum insurance:

Type	Amount
Workmen's Compensation and Employer's Liability Insurance	\$100,000

General Liability Insurance	\$500,000 per occurrence
Automobile Liability Insurance	
Bodily injury	\$200,000 per person and \$500,000 per occurrence
Property damage	\$ 20,000 per occurrence

(Coverages per FAR 28.307-2)

### 1.13 SECURITY REQUIREMENTS

#### 1.13.1 Contractor's Employee Identification

The Contractor shall be responsible for furnishing to each employee and for requiring each employee engaged on the work to display such identification as may be approved and directed by the Contracting Officer. All prescribed identification shall immediately be delivered to the Contracting Officer, for cancellation upon release of any employees. When the contract involves work in restricted security areas, only employees who are U.S. citizens will be permitted to enter. Proof of U.S. citizenship is required prior to entry. When required by the Contracting Officer, the Contractor shall obtain and submit fingerprints of all persons employed or to be employed on the project. (Based on FAR 52.204-2)

#### 1.13.2 Contractor Employees Requiring Access to Automated Information Systems (AIS)

All Contractor employees (U.S. citizens and Non- U.S. citizens) working under this contract (to include grants, cooperative agreements and task orders) who require access to Automated Information Systems (AIS), (stand alone computers, network computers/systems, e-mail) shall, at a minimum, be designated into an ADP-III position (non-sensitive) in accordance with DoD 5220-22-R, Industrial Security Regulation ([http://www.deskbook.osd.mil/htmlfiles/DBY\\_dod-7-Careers.asp](http://www.deskbook.osd.mil/htmlfiles/DBY_dod-7-Careers.asp)). The investigative requirements for an ADP-III position are a favorable National Agency Check (NAC), SF-85P, Public Trust Position.

Proof of a favorable NAC shall be submitted to USACE, Omaha District Security Officer, ATTN: CENWO-SL, 106 S. 15th St, Omaha, NE 68102-1618, within three (3) working days after award of any contract or task order, and shall be submitted prior to the individual being permitted access to an AIS.

a. Contractors who have a commercial or government entity (CAGE) Code and Facility Security Clearance should submit forms through their Facility Security Office, who shall forward results of the NAC to the Omaha District Security Officer (address above).

b. For those Contractors who do not have a CAGE Code or Facility Security Clearance, the SF 85P and 2 copies of the FD-258 (Fingerprint Cards) shall be completed and submitted to the Omaha District Security Officer (address above.) These must be mailed or hand-delivered, as original signatures are required. Fingerprint cards are available upon request and may be taken to any local law enforcement center for completion. For those in the Omaha, Nebraska area, fingerprint cards may be completed by contacting the Omaha District Human Resources Office, (402) 221-4072.

In accordance with Engineering Regulation, ER 380-1-18 (<http://www.usace.army.mil/inet/usace-docs/eng-regs/er.htm>), Section 4, foreign nationals who work on Corps of Engineers' contracts or task orders shall be approved by the HQUSACE Foreign Disclosure Officer or higher before beginning work on the contract/task order. This regulation includes subcontractor employees. (NOTE: exceptions to the above requirement include foreign nationals who perform janitorial and/or ground maintenance services.) The Contractor shall submit to the District Contract Office (CENWO-CT), the names of all foreign nationals proposed for performance under this contract/task order, along with documentation to verify that he/she was legally admitted into the United States and has authority to work and/or go to school in the US. Such documentation may include a US passport, Certificate of US citizenship (INS Form N-560 or N-561), Certificate of Naturalization (INS Form N-550 or N-570), foreign passport with I-551 stamp or attached INS Form I-94 indicating employment authorization, Alien Registration Receipt Card with photograph (INS Form I-151 or I-551), Temporary Resident Card (INS Form I-688), Employment Authorization Card (INS Form I-688A), Reentry Permit (INS Form I-327), Refugee Travel Document (INS Form I-571), Employment Authorization Document issued by the INS which contains a photograph (INS Form I-688B). INS forms are available at <http://www.immigration.gov/graphics/formsfee/index.htm>.

Copy of SF-85P is attached.(End of Provision) (PIL 2003-06, 19 Feb 03)

#### 1.14 CONTRACTOR QUALITY CONTROL (CQC)

See Section 01451A Contractor Quality Control.

#### 1.15 NONDOMESTIC CONSTRUCTION MATERIALS

The List of nondomestic construction materials or their components included in the list set forth in paragraph 25.104 of the Federal Acquisition Regulation does not apply to the requirements of the contract clause entitled "Buy American Act Construction Materials".

#### 1.16 DAILY WORK SCHEDULES

In order to closely coordinate work under this contract, the Contractor shall prepare a written agenda/meeting minutes and attend a weekly coordination meeting with the Contracting Officer and Using Service at which time the Contractor shall submit for coordination and approval, his proposed daily work schedule for the next two week period. The Contractor shall provide a copy of modifications (MODs), Serial Letters, Requests for Information (RFIs) and any other information that is needed in the minutes of the meeting. Required temporary utility services, time and duration of interruptions, and protection of adjoining areas shall be included with the Contractor's proposed 2-week work schedule. At this meeting, the Contractor shall also submit his schedule of proposed dates and times of all preparatory inspections to be performed during the next 2 weeks. The items of work listed on the proposed 2-week schedule are to be keyed to the NAS by activity number and description for each activity anticipated to be performed during the next 2-week period. Coordination action by the Contracting Officer relative to these schedules will be accomplished during these weekly meetings. Daily reports shall be completed and given to the Contracting Officer or Representative within 24 hours of work

#### 1.17 EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE (MAR 1995)

a. This statement shall become operative only for negotiated contracts where cost or pricing data is requested, and for modifications to sealed bid or negotiated contracts where cost or pricing data is requested. This clause does not apply to terminations. See 52.249-5000, Basis for settlement of proposals and FAR Part 49.

b. Allowable cost for construction and marine plant and equipment in sound workable condition owned or controlled and furnished by a Contractor or subcontractor at any tier shall be based on actual cost data for each piece of equipment or groups of similar serial and series for which the Government can determine both ownership and operating costs from the Contractor's accounting records. When both ownership and operating costs cannot be determined for any piece of equipment or groups of similar serial or series of equipment from the Contractor's accounting records, costs for that equipment shall be based upon the applicable provisions of EP 1110-1-8, "Construction Equipment Ownership and Operating Expense Schedule," Region IV. Copies of each regional schedule may be obtained through the following internet site:  
<http://www.usace.army.mil/inet/usace-docs/eng-pamphlets/ep.htm>. Working conditions shall be considered to be average for determining equipment rates using the schedule unless specified otherwise by the Contracting Officer. For equipment not included in the schedule, rates for comparable pieces of equipment may be developed using the formula provided in the schedule. For forward pricing, the Schedule in effect at the time of negotiations shall apply. For retrospective pricing, the Schedule in effect at the time the work was performed shall apply.

c. Equipment rental costs are allowable, subject to the provisions of FAR 31.105(d)(ii) and FAR 31.205-36. Rates for equipment rented from an organization under common control, lease-purchase arrangements, and sale-leaseback arrangements will be determined using the schedule, except that actual rates will be used for equipment leased from an organization under common control that has an established practice of leasing the same or similar equipment to unaffiliated lessees.

d. When actual equipment costs are proposed and the total amount of the pricing action exceeds the small purchase threshold, the contracting officer shall request the contractor to submit either certified cost or pricing data, or partial/limited data as appropriate. The data shall be submitted on Standard Form 1411, Contract Pricing Proposal Cover Sheet. (EFARS 52.231-5000)

#### 1.18 AS-BUILT DRAWINGS

See SECTION 01040 - AS-BUILT DRAWINGS

#### 1.19 PERFORMANCE OF WORK BY CONTRACTOR (APR 1984)

The Contractor shall perform on the site, and with its own organization, work equivalent to at least twenty (20) percent of the total amount of work to be performed under the contract. This percentage may be reduced by a supplemental agreement to this contract if, during performing the work, the Contractor requests a reduction and the Contracting Officer determines that the reduction would be to the advantage of the Government. (FAR 52.236-1)

#### 1.20 PROFIT

a. Weighted guidelines method of determining profit shall be used on any

equitable adjustment change order or modification issued under this contract. The profit factors shall be as follows:

Factor	Rate	Weight	Value
Degree of Risk	20	See Item	
Relative difficulty of work	15	b. below	
Size of Job	15		
Period of performance	15		
Contractor's investment	5		
Assistance by Government	5		
Subcontracting	25		
	100		

b. Based on the circumstances of each procurement action, each of the above factors shall be weighted from .03 to .12 as indicated below. The value shall be obtained by multiplying the rate by the weight. The value column when totalled indicates the fair and reasonable profit percentage under the circumstances of the particular procurement.

(1) Degree of Risk. Where the work involves no risk or the degree of risk is very small, the weighting should be .03; as the degree of risk increases, the weighting should be increased up to a maximum of .12. Lump sum items will have, generally, a higher weighted value than the unit price items for which quantities are provided. Other things to consider: the portion of the work to be done by subcontractors, nature of work, where work is to be performed, reasonableness of negotiated costs, amount of labor included in costs, and whether the negotiation is before or after performance of work.

(2) Relative Difficulty of Work. If the work is most difficult and complex, the weighting should be .12 and should be proportionately reduced to .03 on the simplest of jobs. This factor is tied in to some extent with the degree of risk. Some things to consider: the nature of the work, by whom it is to be done, where, and what is the time schedule.

(3) Size of Job. All work not in excess of \$100,000 shall be weighted at .12. Work estimated between \$100,000 and \$5,000,000 shall be proportionately weighted from .12 to .05.

(4) Periods of Performance. Jobs in excess of 24 months are to be weighted at .12. Jobs of lesser duration are to be proportionately weighted to a minimum of .03 for jobs not to exceed 30 days. No weight where additional time not required.

(5) Contractor's Investment. To be weighted from .03 to .12 on the basis of below average, average, and above average. Things to consider: amount of subcontracting, mobilization payment item, Government furnished property, equipment and facilities, and expediting assistance.

(6) Assistance by Government. To be weighted from .12 to .03 on the basis of average to above average. Things to consider: use of Government-owned property, equipment and facilities, and expediting assistance.

(7) Subcontracting. To be weighted inversely proportional to the amount of subcontracting. Where 80 percent or more of the work is to be subcontracted, the weighting is to be .03 and such weighting proportionately increased to .12 where all the work is performed by the Contractor's own forces.

1.21 DRAWING SCALES

All scales shown are based on a standard drawing size of 28" x 40". If any other size drawings are furnished or plotted, the contractor shall adjust the scales accordingly. The Contractor shall also advise his sub-contractors of the above.

1.22 WAGE RATE APPLICATION

For copies of Wage Rates, See Attachment GENERAL WAGE DECISIONS.

1.22.1 Building Schedule

Applicable to all work required within 5 feet outside the building lines.

1.22.2 Heavy Schedule

Applicable to all work required beyond 5 feet outside the building.

1.23 (FAR 52.222-23) NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY FOR CONSTRUCTION (FEB 1999)

(a) The offeror's attention is called to the Equal Opportunity clause and the Affirmative Action Compliance Requirements for Construction clause of this solicitation.

(b) The goals for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Goals for Minority Participation for Each Trade	Goals for Female Participation for Each Trade
*****	*****
4.1	6.9

These goals are applicable to all the Contractor's construction work performed in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, the Contractor shall apply the goals established for the geographical area where the work is actually performed. Goals are published periodically in the Federal Register in notice form, and these notices may be obtained from any Office of Federal Contract Compliance Programs Office.

(c) The Contractor's compliance with Executive Order 11246, as amended, and the regulations in 41 CFR 60-4 shall be based on (1) its implementation of the Equal Opportunity clause, (2) specific affirmative action obligations required by the clause entitled "Affirmative Action Compliance Requirements for Construction," and (3) its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade. The

Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor, or from project to project, for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, Executive Order 11246, as amended, and the regulations in 41 CFR 60-4. Compliance with the goals will be measured against the total work hours performed.

(d) The Contractor shall provide written notification to the Deputy Assistant Secretary for Federal Contract Compliance, U.S. Department of Labor, within 10 working days following award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the -

- (1) Name, address, and telephone number of the subcontractor;
- (2) Employer identification number of the subcontractor;
- (3) Estimated dollar amount of the subcontract;
- (4) Estimated starting and completion dates of the subcontract; and
- (5) Geographical area in which the subcontract is to be performed.

(e) As used in this Notice, and in any contract resulting from this solicitation, the "covered area" is Great Falls EA-153, which Valley county is a part of.

#### 1.24 (EFARS 52.232-5001) CONTINUING CONTRACTS (MAR 1995)

a. This is a continuing contract, as authorized by Section 10 of the River and Harbor Act of September 22, 1922 (33 U.S. Code 621). The payment of some portion of the contract price is dependent upon reservations of funds from future appropriations, and from future contributions to the project having one or more non-federal project sponsors. The responsibilities of the Government are limited by this clause notwithstanding any contrary provision of the "Payments to Contractor" clause or any other clause of this contract.

b. The sum of \$1,500,000 has been reserved for this contract and is available for payments to the Contractor during the current fiscal year. It is expected that Congress will make appropriations for future fiscal years from which additional funds together with funds provided by one or more non-federal project sponsors will be reserved for this contract.

c. Failure to make payments in excess of the amount currently reserved, or that may be reserved from time to time, shall not entitle the Contractor to a price adjustment under the terms of this contract except as specifically provided in certain paragraphs below. No such failure shall constitute a breach of this contract, except that this provision shall not bar a breach-of-contract action if an amount finally determined to be due as a termination allowance remains unpaid for one year due solely to a failure to reserve sufficient additional funds therefor.

d. The Government may at any time reserve additional funds for payments under the contract if there are funds available for such purpose. The Contracting Officer will promptly notify the Contractor of any additional funds reserved for the contract by issuing an administrative modification

to the contract.

e. If earnings will be such that funds reserved for the contract will be exhausted before the end of any fiscal year, the Contractor shall give written notice to the Contracting Officer of the estimated date of exhaustion and the amount of additional funds which will be needed to meet payments due or to become due under the contract during that fiscal year. This notice shall be given not less than 45 nor more than 60 days prior to the estimated date of exhaustion.

f. No payments will be made after exhaustion of funds except to the extent that additional funds are reserved for the contract. The Contractor shall be entitled to simple interest on any payment that the Contracting Officer determines was actually earned under the terms of the contract and would have been made except for exhaustion of funds. Interest shall be computed from the time such payment would otherwise have been made until actually or constructively made, and shall be at the rate established by the Secretary of the Treasury pursuant to Public Law 92-41, 85 STAT 97, as in effect on the first day of the delay in such payment.

g. Any suspension, delay, or interruption of work arising from exhaustion or anticipated exhaustion of funds shall not constitute a breach of this contract and shall not entitle the Contractor to any price adjustment under the "Suspension of Work" clause or in any other manner under this contract.

h. An equitable adjustment in performance time shall be made for any increase in the time required for performance of any part of the work arising from exhaustion of funds or the reasonable anticipation of exhaustion of funds.

i. If, upon the expiration of sixty (60) days after the beginning of the fiscal year following an exhaustion of funds, the Government has failed to reserve sufficient additional funds to cover payments otherwise due, the Contractor, by written notice delivered to the Contracting Officer at any time before such additional funds are reserved, may elect to treat his right to proceed with the work as having been terminated. Such a termination shall be considered a termination for the convenience of the Government.

j. If at any time it becomes apparent that the funds reserved for any fiscal year are in excess of the funds required to meet all payments due or to become due the Contractor because of work performed and to be performed under the contract during the fiscal year, the Government reserves the right, after notice to the Contractor, to reduce said reservation by the amount of such excess.

#### 1.25 FEDERAL HOLIDAYS

The following Federal legal holidays are observed by this installation:

New Year's Day	1 January
Martin Luther King's Birthday	Third Monday in January
President's Day	Third Monday in February
Memorial Day	Last Monday in May
Independence Day	4 July
Labor Day	First Monday in September
Columbus Day	Second Monday in October
Veterans Day	11 November

Thanksgiving Day  
Christmas Day

Fourth Thursday in November  
25 December

If a wage determination applies the number of holidays specified on it, it has priority over this clause.

PART 2 NOT USED

PART 3 NOT USED

-- End of Section --

General Decision Number MT020003

General Decision Number MT020003 Superseded General Decision No. MT010003

State: Montana

Construction Type:  
BUILDING

County(ies):

BIG HORN	HILL	ROOSEVELT
BLAINE	JUDITH BASIN	ROSEBUD
CARBON	LIBERTY	SHERIDAN
CARTER	MCCONE	STILLWATER
CHOUTEAU	MEAGHER	SWEET GRASS
CUSTER	MUSSELSHELL	TETON
DANIELS	PARK	TOOLE
DAWSON	PETROLEUM	TREASURE
FALLON	PHILLIPS	VALLEY
FERGUS	PONDERA	WHEATLAND
GARFIELD	POWDER RIVER	WIBAUX
GLACIER	PRAIRIE	
GOLDEN VALLEY	RICHLAND	

BUILDING CONSTRUCTION PROJECTS (does not include residential construction consisting of single family homes and apartments up to and including 4 stories)

Modification Number	Publication Date
0	03/01/2002
1	12/27/2002

COUNTY(ies):

BIG HORN	HILL	ROOSEVELT
BLAINE	JUDITH BASIN	ROSEBUD
CARBON	LIBERTY	SHERIDAN
CARTER	MCCONE	STILLWATER
CHOUTEAU	MEAGHER	SWEET GRASS
CUSTER	MUSSELSHELL	TETON
DANIELS	PARK	TOOLE
DAWSON	PETROLEUM	TREASURE
FALLON	PHILLIPS	VALLEY
FERGUS	PONDERA	WHEATLAND
GARFIELD	POWDER RIVER	WIBAUX
GLACIER	PRAIRIE	
GOLDEN VALLEY	RICHLAND	

BRMT0003B 04/01/2000

	Rates	Fringes
CHOUTEAU, FERGUS, JUDITH BASIN, PETROLEUM, PONDERA AND TETON COUNTIES		
BRICKLAYERS	19.50	6.45

BRMT0005A 06/01/2001

	Rates	Fringes
PARK COUNTY		
BRICKLAYERS	25.70	1.75

BRMT0006A 04/01/2000

	Rates	Fringes
MEAGHER COUNTY:		
BRICKLAYERS	19.85	5.65
-----		
BRMT0010A 06/01/2000		
	Rates	Fringes
BIG HORN, CARBON, CARTER, CUSTER, DAWSON, FALLON, GARFIELD, GOLDEN VALLEY, MCCONE, MUSSELSHELL, POWDER RIVER, PRAIRIE, RICHLAND, ROSEBUD, STILLWATER, SWEET GRASS, TREASURE, WHEATLAND, AND WIBAUX COUNTIES		
BRICKLAYERS	18.87	6.08
-----		
BRMT0012A 01/01/2000		
	Rates	Fringes
BLAINE, DANIELS, HILL, LIBERTY, PHILIPS, ROOSEVELT, SHERIDAN, TOOLE, AND VALLEY COUNTIES		
BRICKLAYERS	19.58	6.40
-----		
* PLUM0030A 09/01/2002		
	Rates	Fringes
BIG HORN, BLAINE, CARBON, CARTER, CHOUTEAU, CUSTER, DANIELS, DAWSON, FALLON, FERGUS, GARFIELD, GLACIER, GOLDEN VALLEY, HILL, JUDITH BASIN, LIBERTY, MCCONE, MEAGHER, MUSSELSHELL, PETROLEUM, PHILLIPS, PONDERA, POWDER RIVER, PRAIRIE, RICHLAND, ROOSEVELT, ROSEBUD, SHERIDAN, STILLWATER, TETON, TOOLE, TREASURE, VALLEY, WIBAUX, AND WHEATLAND Counties:		
PLUMBERS & PIPEFITTERS (Including HVAC Piping, and Set unit)	23.90	9.15
-----		
* PLUM0041B 07/01/2002		
	Rates	Fringes
PARK AND SWEET GRASS COUNTIES PLUMBERS & PIPEFITTERS (Including HVAC Piping, and Set unit)	24.30	7.55
-----		
SUMT1006A 02/23/1999		
	Rates	Fringes
CARPENTERS (Including installation of Batt Insulation and Drywall; excluding Form Work and Overhead Door installation)	14.94	4.20
CARPENTERS (Form work only)	15.47	4.45
ELECTRICIANS (Including Alarms; excluding HVAC control wiring)	16.63	3.32
LABORERS:		
General	12.24	3.50
Hod Carriers	13.50	3.75
OVERHEAD DOOR INSTALLER	10.50	1.13
POWER EQUIPMENT OPERATOR:		
Backhoe	16.36	5.32
ROOFERS	13.50	
TRUCK DRIVERS:		
10 cu. yd. Tandem Dump	13.85	

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses

(29 CFR 5.5(a)(1)(ii)).

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In the listing above, the "SU" designation means that rates listed under that identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- \* an existing published wage determination
- \* a survey underlying a wage determination
- \* a Wage and Hour Division letter setting forth a position on a wage determination matter
- \* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations  
Wage and Hour Division  
U. S. Department of Labor  
200 Constitution Avenue, N. W.  
Washington, D. C. 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator  
U.S. Department of Labor  
200 Constitution Avenue, N. W.  
Washington, D. C. 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board  
U. S. Department of Labor  
200 Constitution Avenue, N. W.  
Washington, D. C. 20210

4.) All decisions by the Administrative Review Board are final.

END OF GENERAL DECISION

General Decision Number MT020001

General Decision Number MT020001 Superseded General Decision No. MT010001

State: Montana

Construction Type:  
HEAVY

County(ies):  
STATEWIDE

HEAVY CONSTRUCTION PROJECTS

Modification Number	Publication Date
0	03/01/2002
1	06/14/2002
2	12/27/2002

COUNTY(ies):  
STATEWIDE

ZONE DEFINITIONS

CARPENTERS, \*CEMENT MASONS, LABORERS, POWER EQUIPMENT OPERATORS,  
AND TRUCK DRIVERS

The zone hourly rates applicable to each project shall be determined by measuring the road miles over the shortest practical maintained route from the nearest County Court House of the following listed towns to the center of the job:

Billings	Great Falls	Kalispell	Missoula
Bozeman	Havre	Lewistown	
Butte	Helena	Miles City	

ZONE 1: 0 to 30 miles	Base Pay
ZONE 2: 30 to 60 miles	Base Pay + \$2.20
ZONE 3: Over 60 miles	Base Pay + \$3.70

\*CEMENT MASONS ZONES: The above cities plus  
DILLON            GLASGOW            GLENDIVE            SIDNEY

-----  
CARP0028B 05/16/2000

	Rates	Fringes
STATEWIDE EXCEPT BEAVERHEAD AND SILVER BOW COUNTIES		
CARPENTERS:		
ZONE 1:		
Carpenters	18.65	4.55
Piledrivermen	18.65	4.55
Millwrights	20.15	4.55

-----  
CARP0028D 06/01/2000

	Rates	Fringes
STATEWIDE EXCEPT BEAVERHEAD AND SILVER BOW COUNTIES		
DIVERS	54.93	5.70
TENDERS	26.25	5.70

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CARP0112A 05/01/1998

	Rates	Fringes
BEAVERHEAD AND SILVER BOW COUNTIES		
CARPENTERS [Zone pay not applicable]:		
Carpenter	16.71	4.82

Millwright	17.21	4.82
Pile Driver	17.71	4.82

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 ELEC0044A 06/01/2002

	Rates	Fringes
BEAVERHEAD, BIG HORN, BLAINE, BROADWATER, CARBON, CARTER, CASCADE, CHOUTEAU, CUSTER, DANIELS, DAWSON, DEER LODGE, FALLON, FERGUS, GALLATIN, GARFIELD, GLACIER, GOLDEN VALLEY, GRANITE, HILL, JEFFERSON, JUDITH, BASIN, LEWIS AND CLARK, LIBERTY, MADISON, MCCONE, MEAGHER, MINERAL, MISSOULA, MUSSELSHELL, PARK, PETROLEUM, PHILLIPS, PONDERA, POWDER RIVER, POWELL, PRAIRIE, RAVALLI, RICHLAND, ROOSEVELT, ROSEBUD, SHERIDAN, SILVER BOW, STILLWATER, SWEET GRASS, TETON, TOOLE, TREASURE, VALLEY, WHEATLAND, WIBAUX, AND YELLOWSTONE COUNTIES		
LINE CONSTRUCTION:		
Lineman	25.79	4.25%+6.71
Equipment Operator	20.63	4.25%+6.34
Experienced Groundman	16.76	4.25%+6.07

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 ELEC0233A 06/01/2001

	Rates	Fringes
BLAINE, CASCADE, CHOUTEAU, FERGUS, GLACIER, HILL, JUDITH BASIN, LIBERTY, PETROLEUM, PHILLIPS, PONDERA, TETON, TOOLE, VALLEY, AND WHEATLAND COUNTIES		
ELECTRICIANS	22.13	4.25%+6.14

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 ELEC0233B 06/01/2001

	Rates	Fringes
BEAVERHEAD, DEER LODGE, GRANITE, JEFFERSON, MADISON, POWELL, AND SILVER BOW COUNTIES		
ELECTRICIANS	21.65	4.25%+6.56

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 ELEC0233F 06/01/2001

	Rates	Fringes
BROADWATER, LEWIS AND CLARK, AND MEAGHER COUNTIES		
ELECTRICIANS	22.13	4.25%+6.14

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 ELEC0532A 06/01/2001

	Rates	Fringes
GALLATIN, PARK, AND SWEET GRASS COUNTIES		
ELECTRICIANS	20.74	4.25%+6.07

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 ELEC0532C 06/01/2001

	Rates	Fringes
BIG HORN, CARBON, CARTER, CUSTER, DANIELS, DAWSON, FALLON, GARFIELD, GOLDEN VALLEY, MCCONE, MUSSELSHELL, POWDER RIVER, PRAIRIE, RICHLAND, ROOSEVELT, ROSEBUD, SHERIDAN, STILLWATER, TREASURE, WIBAUX AND YELLOWSTONE COUNTIES		
ELECTRICIANS	22.63	4.25%+6.46

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 ELEC0768A 06/01/2001

	Rates	Fringes
FLATHEAD, LAKE, LINCOLN, MINERAL, MISSOULA, RAVALLI, AND SANDERS COUNTIES		
ELECTRICIANS	23.00	7.28

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 ELEC0768C 12/01/2000

	Rates	Fringes
FLATHEAD, LAKE, AND LINCOLN COUNTIES		
LINE CONSTRUCTION:		
Cable Splicer	26.79	4.25%+6.41
Lineman	24.61	4.25%+6.32
Tree Trimmer	21.96	4.25%+6.21
Pole Sprayer	21.12	4.25%+6.17
Line Equipment Operator	20.28	4.25%+6.14
Experienced Groundman	16.24	4.25%+5.96

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 ENGI0400A 05/01/2001

	Rates	Fringes
POWER EQUIPMENT OPERATORS:		
ZONE 1:		
GROUP 1	17.74	4.90
GROUP 2	18.16	4.90
GROUP 3	18.53	4.90
GROUP 4	18.78	4.90
GROUP 5	19.76	4.90
GROUP 6	20.27	4.90
GROUP 7	21.81	4.90
POWER EQUIPMENT OPERATORS CLASSIFICATIONS		
GROUP 1: Air Compressor; Auto Fine Grader; Belt Finishing Machine; Boring Machine, small; Cement Silo; Crane, A-Frame Truck Crane; Crusher Conveyor; DW-10, 15, and 20 Tractor Roller; Farm Tractor; Forklift; Form Grader; Front-end Loader under 1 cu yd; Heavy Duty Drills; Herman Nelson Heater; Mulching Machine; Oiler, all except Cranes. & Shovels; Pumpman.		
GROUP 2: Air Doctor; Backhoe/Excavator/Shovel to and including 3 cu yd; Bit Grinder; Bituminous Paving Travel Plant; Boring Machine, large; Broom, self-propelled; Concrete Travel Batchter; Concrete Float & Spreader; Concrete Bucket Dispatcher; Concrete Finish Machine; Concrete Conveyor; Distributor; Dozer, Rubber-Tired, Push & Side Boom; Elevating Grader/Gradall; Field Equipment Serviceman; Front-end Loader 1 cu yd to including 5 cu yd; Grade Setter; Heavy Duty Drills, all types; Hoist/Tugger, all; Hydralift & similar; Industrial Locomotive; Motor Patrol, except Finish; Mountain Skidder; Oiler - Cranes & Shovels; Pavement Breaker, EMSCO; Power Saw, self-propelled; Pugmill; Pumpcrete/Grout Machine; Punch Truck; Roller, other than Asphalt; Roller, Sheepsfoot, self-propelled; Roller, 25 tons and over; Ross Carrier; Rotomill under 6 ft; Trenching Machine; Washing/Screening Plant.		
GROUP 3: Asphalt Paving Machine; Asphalt Screed; Backhoe/Excavator/Shovel over 3 cu yd; Cableway Highline; Concrete Batch Plant; Concrete Curing Machine; Concrete Pump; Cranes, Creter; Cranes, Electric Overhead; Cranes, 24 tons and under; Curb Machine/Slip Form Paver; Finish Dozer; Front-end Loader over 5 cu yd; Mechanic/Welder; Pioneer Dozer; Roller, Asphalt (Breakdown & Finish); Rotomill, over 6 ft; Scraper, single, twin, or pulling Belly Dump; Yo-Yo Cat.		
GROUP 4: Asphalt/Hot Plant Operator; Cranes, 25 tons to 44 tons; Crusher Operator; Finish Motor Patrol; Finish Scraper.		
GROUP 5: Cranes, 45 tons to including 74 tons; Crane, Tower, all.		
GROUP 6: Cranes, 75 tons to including 149 tons; Crane, Whirley, all.		

GROUP 7: Cranes, 150 tons to including 250 tons (add \$1.00 for every 100 tons over 250 tons); Crane, Stiff-Leg or Derrick; Helicopter Hoist.

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 \* IRON0014C 07/01/2002

	Rates	Fringes
FLATHEAD, GLACIER, LAKE, LINCOLN, MINERAL, MISSOULA, AND SANDERS COUNTIES		
IRONWORKERS	21.17	10.98

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 \* IRON0841B 07/01/2002

	Rates	Fringes
REMAINING COUNTIES		
IRONWORKERS	18.80	11.86

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 LABO0098A 05/01/2000

	Rates	Fringes
LABORERS:		
ZONE 1:		
GROUP 1	13 41	4.40
GROUP 2	16.19	4.40
GROUP 3	16.33	4.40
GROUP 4	17.05	4.40

LABORERS CLASSIFICATIONS

GROUP 1: Flagperson

GROUP 2: All General Labor work; Burning Bar; Bucket man; Carpenter Tender; Caisson Worker; Cement Mason Tender; Cement Handler (dry); Chuck Tender; Choker Setter; Concrete worker; Curb Machine-Lay Down; Crusher and Batch worker; Fence Erector; Form Setter; Form Stripper; Heater Tender; Landscaper; Pipe Wrapper; Pot Tender; Powderman Tender; Rail and Truck Loaders and Unloaders; Riprapper; Sealants for concrete and other materials; Sign Erection, Guard Rail and Jersey Rail; Stake Jumper; Spike Driver; Signalman; Tail Hoseman; Tool Checker and Houseman; Traffic Control worker.

GROUP 3: Concrete Vibrator; Dumpman (Grademan); Equipment Handler; Geotextile and Liners; High-Pressure Nozzleman; Jackhammer (Pavement Breaker); Laser Equipment; Non-Riding Rollers; Pipelayer; Posthole Digger (Power); Power Driven Wheelbarrow; Rigger; Sandblaster; Sod Cutter-Power; Tampers

GROUP 4: Asphalt Raker; Cutting Torch; Grade Setter; High-Scaler; Power Saws (Faller & Concrete); Powderman (\$1.00 per hour above Group 4 rate); Rock & Core Drill; Track or Truck mounted Wagon Drill; Welder including Air Arc

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 \* PAIN0260A 07/01/2002

	Rates	Fringes
BLAINE, BROADWATER, CASCADE, CHOUTEAU, DANIELS, FERGUS, GARFIELD, GLACIER, GRANITE (South of a line running East & West through the Southern city limits of Phillipsburg), HILL, JEFFERSON, JUDITH BASIN, LEWIS AND CLARK, LIBERTY, McCONE, MEAGHER, PETROLEUM, PHILLIPS, PONDERA, POWELL (South of a line running East & West through the Southern City limits of Helmsville), RICHLAND, ROOSEVELT, SHERIDAN, TETON, TOOLE, VALLEY, AND WHEATLAND COUNTIES		
PAINTERS	13.85	1%+3.45

\* PAIN0260C 07/01/2002

	Rates	Fringes
FLATHEAD, GRANITE (North of a line running East & West through the Southern city limits of Phillipsburg), LAKE, LINCOLN, MINERAL, MISSOULA, POWELL (North of a line running East & West through the Southern city limits of Helmsville), RAVALLI, AND SANDERS COUNTIES		
PAINTERS	16.85	1%+3.45

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PAIN1922A 06/01/2000

	Rates	Fringes
BEAVERHEAD, BIG HORN, CARBON, CARTER, CUSTER, DAWSON, DEER LODGE, FALLON, GALLATIN, GOLDEN VALLEY, JEFFERSON, MADISON, MUSSELSHELL, PARK, POWDER RIVER, PRAIRIE, ROSEBUD, SILVER BOW, STILLWATER, SWEET GRASS, TREASURE, WIBAUX, AND YELLOWSTONE COUNTIES		
INDUSTRIAL PAINTERS [Includes Industrial Plants, Tanks, Pipes, Bridges]	17.55	7.13

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PLAS0119A 05/01/2000

	Rates	Fringes
STATEWIDE (except Deer Lodge, Jefferson, Powell, and Silver Bow Counties)		
CEMENT MASONS:		
ZONE 1	16.23	5.10
DEER LODGE, JEFFERSON, POWELL, AND SILVER BOW COUNTIES		
CEMENT MASONS:		
ZONE 1	17.30	5.10

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\* PLUM0030C 09/01/2002

	Rates	Fringes
BIGHORN, BLAINE, CARBON, CARTER, CASCADE, CHOUTEAU, CUSTER, DANIELS, DAWSON, FALLON, FERGUS, GARFIELD, GLACIER, GOLDEN VALLEY, HILL, JUDITH BASIN, LIBERTY, McCONE, MEAGHER, MUSSELSHELL, PETROLEUM, PHILLIPS, PONDERA, POWDER RIVER, PRAIRIE, RICHLAND, ROOSEVELT, ROSEBUD, SHERIDAN, STILLWATER, TETON, TOOLE, TREASURE, VALLEY, WHEATLAND, WIBAUX AND YELLOWSTONE COUNTIES		
PLUMBERS	23.90	9.15

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\* PLUM0041A 07/01/2002

	Rates	Fringes
BEAVERHEAD, BROADWATER, DEER LODGE, GALLATIN, GRANITE, JEFFERSON, LEWIS AND CLARK, MADISON, PARK, POWELL, SILVER BOW, AND SWEET GRASS COUNTIES		
PLUMBERS	24.30	7.55

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PLUM0459A 05/01/2002

	Rates	Fringes
FLATHEAD, GLACIER, LAKE, LINCOLN, MINERAL, MISSOULA, RAVALLI, AND SANDERS		
PLUMBERS	22.66	8.25

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TEAM0002A 06/01/1999

	Rates	Fringes
TRUCK DRIVERS:		
ZONE 1:		

GROUP 1	13.31	4.96
GROUP 2	17.34	4.96

TRUCK DRIVERS CLASSIFICATIONS:

GROUP 1: Pilot Car

GROUP 2: All Combination Trucks and Concrete Mixers; Distributor Driver; All Dry Batch Trucks; Dumpman, Gravel Spreader Box Operator; All Dump Trucks and similar equipment including DW 20, DW 21, or Euclid Tractor; Dumpsters; Flat Trucks; Servicemen; Lowboys, Four-Wheel Trailers; Float Semi-Trailer; Lumber Carriers, Lift Trucks & Fork Lifts; Pick-up Driver hauling material; Powder Truck (Bulk Unloader type); Power Boom; Service Truck Drivers, Fuel Truck Drivers, Tiremen; All Water Tank Drivers; Petroleum Products Drivers; Trucks with Power Equipment such as Winch, A-Frame Truck, Crane, Hydralift, Gout-Crete Truck, and Combination Mulching, Seeding & Fertilizing Truck; Truck Mechanic

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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.  
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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29 CFR 5.5(a)(1)(ii)).

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In the listing above, the "SU" designation means that rates listed under that identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- \* an existing published wage determination
- \* a survey underlying a wage determination
- \* a Wage and Hour Division letter setting forth a position on a wage determination matter
- \* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations  
Wage and Hour Division  
U. S. Department of Labor  
200 Constitution Avenue, N. W.  
Washington, D. C. 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator

(See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator  
U.S. Department of Labor  
200 Constitution Avenue, N. W.  
Washington, D. C. 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board  
U. S. Department of Labor  
200 Constitution Avenue, N. W.  
Washington, D. C. 20210

4.) All decisions by the Administrative Review Board are final.

END OF GENERAL DECISION

**Contractor Distribution List for Project**

Name: \_Rearing Ponds and Hatchery Complex, Fort Peck Fish Hatchery\_\_\_\_\_

Location: \_Fort Peck, Montana\_\_\_\_\_

Sol. No. :   DACW45-03-B-0010

P.M.: \_Ted H. Streckfuss, Env. P.E.\_\_\_\_\_ Ext. \_221-3826\_\_\_\_\_

Contractor shall reproduce multiple hardcopy sets of contract drawings from government provided CD Rom. Drawings shall be forwarded to addresses listed below.

Address	Full Size	Half Size
Black Hills Area Office U.S. Army Corps of Engineers 2100 South Seventh, Suite L-17 Rapid City, SD 57701	1	3
Ellsworth AFB Resident Office U.S. Army Corps of Engineers P.O. Box 669 Box Elder, SD 57719	1	2
Fort Peck Project Office P.O. Box 208 Fort Peck, MT 59223-0208	1	3
U.S. Army Corps of Engineers Attn: CENWO-CT (D. Boganowski) 106 South 15th Street Omaha, Nebraska 68102-1618	0	18
Montana Department of Fish, Wildlife and Parks Attn: Gary Bertellotti 1420 East 6th Avenue PO Box 200701 Helena, MT 59620		6
Montana Department of Fish, Wildlife and Parks Miles City Fish Hatchery Attn: Mike Rhodes PO Box 756 Miles City, MT 59301		1
<b>Total Copies:</b>	<u>3</u>	<u>33</u>
	Full Size	Half Size

# Questionnaire for Public Trust Positions

Follow instructions fully or we cannot process your form. Be sure to sign and date the certification statement on Page 7 and the release on Page 8. *If you have any questions*, call the office that gave you the form.

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## Purpose of this Form

The U.S. Government conducts background investigations and reinvestigations to establish that applicants or incumbents either employed by the Government or working for the Government under contract, are suitable for the job and/or eligible for a public trust or sensitive position. Information from this form is used primarily as the basis for this investigation. Complete this form only after a conditional offer of employment has been made.

Giving us the information we ask for is voluntary. However, we may not be able to complete your investigation, or complete it in a timely manner, if you don't give us each item of information we request. This may affect your placement or employment prospects.

## Authority to Request this Information

The U.S. Government is authorized to ask for this information under Executive Orders 10450 and 10577, sections 3301 and 3302 of title 5, U.S. Code; and parts 5, 731, 732, and 736 of Title 5, Code of Federal Regulations.

Your Social Security number is needed to keep records accurate, because other people may have the same name and birth date. Executive Order 9397 also asks Federal agencies to use this number to help identify individuals in agency records.

## The Investigative Process

Background investigations are conducted using your responses on this form and on your Declaration for Federal Employment (OF 306) to develop information to show whether you are reliable, trustworthy, of good conduct and character, and loyal to the United States. The information that you provide on this form is confirmed during the investigation. Your current employer must be contacted as part of the investigation, even if you have previously indicated on applications or other forms that you do not want this.

In addition to the questions on this form, inquiry also is made about a person's adherence to security requirements, honesty and integrity, vulnerability to exploitation or coercion, falsification, misrepresentation, and any other behavior, activities, or associations that tend to show the person is not reliable, trustworthy, or loyal.

## Your Personal Interview

Some investigations will include an interview with you as a normal part of the investigative process. This provides you the opportunity to update, clarify, and explain information on your form more completely, which often helps to complete your investigation faster. It is important that the interview be conducted as soon as possible after you are contacted. Postponements will delay the processing of your investigation, and declining to be interviewed may result in your investigation being delayed or canceled.

You will be asked to bring identification with your picture on it, such as a valid State driver's license, to the interview. There are other documents you may be asked to bring to verify your identity as well.

These include documentation of any legal name change, Social Security card, and/or birth certificate.

You may also be asked to bring documents about information you provided on the form or other matters requiring specific attention. These matters include alien registration, delinquent loans or taxes, bankruptcy, judgments, liens, or other financial obligations, agreements involving child custody or support, alimony or property settlements, arrests, convictions, probation, and/or parole.

## Instructions for Completing this Form

1. Follow the instructions given to you by the person who gave you the form and any other clarifying instructions furnished by that person to assist you in completion of the form. Find out how many copies of the form you are to turn in. You must sign and date, in black ink, the original and each copy you submit.
2. Type or legibly print your answers in black ink (if your form is not legible, it will not be accepted). You may also be asked to submit your form in an approved electronic format.
3. All questions on this form must be answered. If no response is necessary or applicable, indicate this on the form (for example, enter "None" or "N/A"). If you find that you cannot report an exact date, approximate or estimate the date to the best of your ability and indicate this by marking "APPROX." or "EST."
4. Any changes that you make to this form after you sign it must be initialed and dated by you. Under certain limited circumstances, agencies may modify the form consistent with your intent.
5. You must use the State codes (abbreviations) listed on the back of this page when you fill out this form. Do not abbreviate the names of cities or foreign countries.
6. The 5-digit postal ZIP codes are needed to speed the processing of your investigation. The office that provided the form will assist you in completing the ZIP codes.
7. All telephone numbers must include area codes.
8. All dates provided on this form must be in Month/Day/Year or Month/Year format. Use numbers (1-12) to indicate months. For example, June 10, 1978, should be shown as 6/10/78.
9. Whenever "City (Country)" is shown in an address block, also provide in that block the name of the country when the address is outside the United States.
10. If you need additional space to list your residences or employments/self-employments/unemployments or education, you should use a continuation sheet, SF 86A. If additional space is needed to answer other items, use a blank piece of paper. Each blank piece of paper you use must contain **your name and Social Security Number at the top of the page.**

## Final Determination on Your Eligibility

Final determination on your eligibility for a public trust or sensitive position and your being granted a security clearance is the responsibility of the Office of Personnel Management or the Federal agency that requested your investigation. You may be provided the opportunity personally to explain, refute, or clarify any information before a final decision is made.

## Penalties for Inaccurate or False Statements

The U.S. Criminal Code (title 18, section 1001) provides that knowingly falsifying or concealing a material fact is a felony which may result in fines of up to \$10,000, and/or 5 years imprisonment, or both. In addition, Federal agencies generally fire, do not grant a security clearance, or disqualify individuals who have materially and deliberately falsified these forms, and this remains a part of the permanent record for future placements. Because the position for which you are being considered is one of public trust or is sensitive, your trustworthiness is a very important consideration in deciding your suitability for placement or retention in the position.

Your prospects of placement are better if you answer all questions truthfully and completely. You will have adequate opportunity to explain any information you give us on the form and to make your comments part of the record.

## Disclosure of Information

The information you give us is for the purpose of investigating you for a position; we will protect it from unauthorized disclosure. The collection, maintenance, and disclosure of background investigative information is governed by the Privacy Act. The agency which requested the investigation and the agency which conducted the investigation have published notices in the Federal Register describing the system of records in which your records will be maintained. You may obtain copies of the relevant notices from the person who gave you this form. The information on this form, and information we collect during an investigation may be disclosed without your consent as permitted by the Privacy Act (5 USC 552a(b)) and as follows:

## PRIVACY ACT ROUTINE USES

1. To the Department of Justice when: (a) the agency or any component thereof; or (b) any employee of the agency in his or her official capacity; or (c) any employee of the agency in his or her individual capacity where the Department of Justice has agreed to represent the employee; or (d) the United States Government, is a party to litigation or has interest in such litigation, and by careful review, the agency determines that the records are both relevant and necessary to the litigation and the use of such records by the Department of Justice is therefore deemed by the agency to be for a purpose that is compatible with the purpose for which the agency collected the records.
2. To a court or adjudicative body in a proceeding when: (a) the agency or any component thereof; or (b) any employee of the agency in his or her official capacity; or (c) any employee of the agency in his or her individual capacity where the Department of Justice has agreed to represent the employee; or (d) the United States Government is a party to litigation or has interest in such litigation, and by careful review, the agency determines that the records are both relevant and necessary to the litigation and the use of such records is therefore deemed by the agency to be for a purpose that is compatible with the purpose for which the agency collected the records.
3. Except as noted in Question 21, when a record on its face, or in conjunction with other records, indicates a violation or potential violation of law, whether civil, criminal, or regulatory in nature, and whether arising by general statute, particular program statute, regulation, rule, or order issued pursuant thereto, the relevant records may be disclosed to the appropriate Federal, foreign, State, local, tribal, or other public authority responsible for enforcing, investigating or prosecuting such violation or charged with enforcing or implementing the statute, rule, regulation, or order.
4. To any source or potential source from which information is requested in the course of an investigation concerning the hiring or retention of an employee or other personnel action, or the issuing or retention of a security clearance, contract, grant, license, or other benefit, to the extent necessary to identify the individual, inform the source of the nature and purpose of the investigation, and to identify the type of information requested.
5. To a Federal, State, local, foreign, tribal, or other public authority the fact that this system of records contains information relevant to the retention of an employee, or the retention of a security clearance, contract, license, grant, or other benefit. The other agency or licensing organization may then make a request supported by written consent of the individual for the entire record if it so chooses. No disclosure will be made unless the information has been determined to be sufficiently reliable to support a referral to another office within the agency or to another Federal agency for criminal, civil, administrative, personnel, or regulatory action.
6. To contractors, grantees, experts, consultants, or volunteers when necessary to perform a function or service related to this record for which they have been engaged. Such recipients shall be required to comply with the Privacy Act of 1974, as amended.
7. To the news media or the general public, factual information the disclosure of which would be in the public interest and which would not constitute an unwarranted invasion of personal privacy.
8. To a Federal, State, or local agency, or other appropriate entities or individuals, or through established liaison channels to selected foreign governments, in order to enable an intelligence agency to carry out its responsibilities under the National Security Act of 1947 as amended, the CIA Act of 1949 as amended, Executive Order 12333 or any successor order, applicable national security directives, or classified implementing procedures approved by the Attorney General and promulgated pursuant to such statutes, orders or directives.
9. To a Member of Congress or to a Congressional staff member in response to an inquiry of the Congressional office made at the written request of the constituent about whom the record is maintained.
10. To the National Archives and Records Administration for records management inspections conducted under 44 USC 2904 and 2906.
11. To the Office of Management and Budget when necessary to the review of private relief legislation.

## STATE CODES (ABBREVIATIONS)

Alabama	AL	Hawaii	HI	Massachusetts	MA	New Mexico	NM	South Dakota	SD
Alaska	AK	Idaho	ID	Michigan	MI	New York	NY	Tennessee	TN
Arizona	AZ	Illinois	IL	Minnesota	MN	North Carolina	NC	Texas	TX
Arkansas	AR	Indiana	IN	Mississippi	MS	North Dakota	ND	Utah	UT
California	CA	Iowa	IA	Missouri	MO	Ohio	OH	Vermont	VT
Colorado	CO	Kansas	KS	Montana	MT	Oklahoma	OK	Virginia	VA
Connecticut	CT	Kentucky	KY	Nebraska	NE	Oregon	OR	Washington	WA
Delaware	DE	Louisiana	LA	Nevada	NV	Pennsylvania	PA	West Virginia	WV
Florida	FL	Maine	ME	New Hampshire	NH	Rhode Island	RI	Wisconsin	WI
Georgia	GA	Maryland	MD	New Jersey	NJ	South Carolina	SC	Wyoming	WY
American Samoa	AS	District of Columbia	DC	Guam	GU	Northern Marianas	CM	Puerto Rico	PR
Trust Territory	TT	Virgin Islands	VI						

## PUBLIC BURDEN INFORMATION

Public burden reporting for this collection of information is estimated to average 60 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Reports and Forms Management Officer, U.S. Office of Personnel Management, 1900 E Street, N.W., Room CHP-500, Washington, D.C. 20415. Do not send your completed form to this address.

**QUESTIONNAIRE FOR  
 PUBLIC TRUST POSITIONS**

OPM USE ONLY	Codes	Case Number
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**Agency Use Only (Complete items A through P using instructions provided by USOPM)**

<b>A</b> Type of Investigation	<b>B</b> Extra Coverage	<b>C</b> Sensitivity/Risk Level	<b>D</b> Compu/ADP	<b>E</b> Nature of Action Code	<b>F</b> Date of Action	Month	Day	Year
<b>G</b> Geographic Location	<b>H</b> Position Code	<b>I</b> Position Title						
<b>J</b> SON	<b>K</b> Location of Official Personnel Folder	None NPRC At SON	Other Address			ZIP Code		
<b>L</b> SOI	<b>M</b> Location of Security Folder	None At SOI NPI	Other Address			ZIP Code		
<b>N</b> OPAC-ALC Number	<b>O</b> Accounting Data and/or Agency Case Number							
<b>P</b> Requesting Official	Name and Title			Signature		Telephone Number		Date

**Persons completing this form should begin with the questions below.**

<b>1 FULL NAME</b>	• If you have only initials in your name, use them and state (IO). • If you have no middle name, enter "NMN".	- If you are a "Jr.," "Sr.," "II," etc., enter this in the box after your middle name.	<b>2 DATE OF BIRTH</b>
Last Name	First Name	Middle Name	Jr., II, etc.
			Month   Day   Year

<b>3 PLACE OF BIRTH</b> - Use the two letter code for the State.	<b>4 SOCIAL SECURITY NUMBER</b>		
City	County	State	Country (if not in the United States)

**5 OTHER NAMES USED**

#1 Name	Month/Year	To	Month/Year	#3 Name	Month/Year	To	Month/Year
#2 Name	Month/Year	To	Month/Year	#4 Name	Month/Year	To	Month/Year

<b>6 OTHER IDENTIFYING INFORMATION</b>	Height (feet and inches)	Weight (pounds)	Hair Color	Eye Color	Sex (Mark one box)
					<input type="checkbox"/> Female <input type="checkbox"/> Male

<b>7 TELEPHONE NUMBERS</b>	Work (include Area Code and extension)	Home (include Area Code)
	Day Night ( )	Day Night ( )

<b>8 CITIZENSHIP</b>	<b>b</b> Your Mother's Maiden Name
<b>a</b> Mark the box at the right that reflects your current citizenship status, and follow its instructions.	
<input type="checkbox"/> I am a U.S. citizen or national by birth in the U.S. or U.S. territory/possession. Answer items b and d.	
<input type="checkbox"/> I am a U.S. citizen, but I was NOT born in the U.S. Answer items b, c and d.	
<input type="checkbox"/> I am not a U.S. citizen. Answer items b and e.	

**c** UNITED STATES CITIZENSHIP If you are a U.S. Citizen, but were not born in the U.S., provide information about one or more of the following proofs of your citizenship.

Naturalization Certificate (Where were you naturalized?)

Court	City	State	Certificate Number	Month/Day/Year Issued
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Citizenship Certificate (Where was the certificate issued?)

City	State	Certificate Number	Month/Day/Year Issued
------	-------	--------------------	-----------------------

State Department Form 240 - Report of Birth Abroad of a Citizen of the United States

Give the date the form was prepared and give an explanation if needed.	Month/Day/Year	Explanation
--	----------------	-------------

U.S. Passport

This may be either a current or previous U.S. Passport	Passport Number	Month/Day/Year Issued
--	-----------------	-----------------------

**d** DUAL CITIZENSHIP If you are (or were) a dual citizen of the United States and another country, provide the name of that country in the space to the right.

	Country
--	---------

**e** ALIEN If you are an alien, provide the following information:

Place You Entered the United States:	City	State	Date You Entered U.S.	Alien Registration Number	Country(ies) of Citizenship
			Month   Day   Year		

**9 WHERE YOU HAVE LIVED**

List the places where you have lived, beginning with the most recent (#1) and working back 7 years. All periods must be accounted for in your list. Be sure to indicate the actual physical location of your residence: do not use a post office box as an address, do not list a permanent address when you were actually living at a school address, etc. Be sure to specify your location as closely as possible: for example, do not list only your base or ship, list your barracks number or home port. You may omit temporary military duty locations under 90 days (list your permanent address instead), and you should use your APO/FPO address if you lived overseas.

For any address in the last 5 years, list a person who knew you at that address, and who preferably still lives in that area (do not list people for residences completely outside this 5-year period, and do not list your spouse, former spouses, or other relatives). Also for addresses in the last 5 years, if the address is "General Delivery," a Rural or Star Route, or may be difficult to locate, provide directions for locating the residence on an attached continuation sheet.

Month/Year <b>#1</b>	Month/Year To	Month/Year Present	Street Address	Apt. #	City (Country)	State	ZIP Code
Name of Person Who Knows You			Street Address	Apt. #	City (Country)	State	ZIP Code
Telephone Number ( )							
Month/Year <b>#2</b>	Month/Year To	Month/Year	Street Address	Apt. #	City (Country)	State	ZIP Code
Name of Person Who Knew You			Street Address	Apt. #	City (Country)	State	ZIP Code
Telephone Number ( )							
Month/Year <b>#3</b>	Month/Year To	Month/Year	Street Address	Apt. #	City (Country)	State	ZIP Code
Name of Person Who Knew You			Street Address	Apt. #	City (Country)	State	ZIP Code
Telephone Number ( )							
Month/Year <b>#4</b>	Month/Year To	Month/Year	Street Address	Apt. #	City (Country)	State	ZIP Code
Name of Person Who Knew You			Street Address	Apt. #	City (Country)	State	ZIP Code
Telephone Number ( )							
Month/Year <b>#5</b>	Month/Year To	Month/Year	Street Address	Apt. #	City (Country)	State	ZIP Code
Name of Person Who Knew You			Street Address	Apt. #	City (Country)	State	ZIP Code
Telephone Number ( )							

**10 WHERE YOU WENT TO SCHOOL**

List the schools you have attended, beyond Junior High School, **beginning with the most recent (#1) and working back 7 years**. List **all** College or University degrees and the dates they were received. If all of your education occurred more than 7 years ago, list your most recent education beyond high school, no matter when that education occurred.

Use one of the following codes in the "Code" block:

1 - High School

2 - College/University/Military College

3 - Vocational/Technical/Trade School

For schools you attended in the past 3 years, list a person who knew you at school (an instructor, student, etc.). Do not list people for education completely outside this 3-year period.

For correspondence schools and extension classes, provide the address where the records are maintained.

Month/Year <b>#1</b>	Month/Year To	Code	Name of School	Degree/Diploma/Other	Month/Year Awarded		
Street Address and City (Country) of School					State	ZIP Code	
Name of Person Who Knew You			Street Address	Apt. #	City (Country)	State	ZIP Code
Telephone Number ( )							
Month/Year <b>#2</b>	Month/Year To	Code	Name of School	Degree/Diploma/Other	Month/Year Awarded		
Street Address and City (Country) of School					State	ZIP Code	
Name of Person Who Knew You			Street Address	Apt. #	City (Country)	State	ZIP Code
Telephone Number ( )							
Month/Year <b>#3</b>	Month/Year To	Code	Name of School	Degree/Diploma/Other	Month/Year Awarded		
Street Address and City (Country) of School					State	ZIP Code	
Name of Person Who Knew You			Street Address	Apt. #	City (Country)	State	ZIP Code
Telephone Number ( )							

Enter your Social Security Number before going to the next page

**11 YOUR EMPLOYMENT ACTIVITIES**

List your employment activities, beginning with the present (#1) and working back 7 years. You should list all full-time work, part-time work, military service, temporary military duty locations over 90 days, self-employment, other paid work, and all periods of unemployment. The entire 7-year period must be accounted for without breaks, but you need not list employments before your 16th birthday.

● **Code.** Use one of the codes listed below to identify the type of employment:

- |                                   |   |  |           |
|-----------------------------------|---|--|-----------|
| 1 - Active military duty stations | 5 - State Government (Non-Federal employment)                               | 7 - Unemployment (Include name of person who can verify)     | 9 - Other |
| 2 - National Guard/Reserve        |   |  |           |
| 3 - U.S.P.H.S. Commissioned Corps | 6 - Self-employment (Include business and/or name of person who can verify) | 8 - Federal Contractor (List Contractor, not Federal agency) |           |
| 4 - Other Federal employment      |   |  |           |

● **Employer/Verifier Name.** List the business name of your employer or the name of the person who can verify your self-employment or unemployment in this block. If military service is being listed, include your duty location or home port here as well as your branch of service. You should provide separate listings to reflect changes in your military duty locations or home ports.

● **Previous Periods of Activity.** Complete these lines if you worked for an employer on more than one occasion at the same location. After entering the most recent period of employment in the initial numbered block, provide previous periods of employment at the same location on the additional lines provided. For example, if you worked at XY Plumbing in Denver, CO, during 3 separate periods of time, you would enter dates and information concerning the most recent period of employment first, and provide dates, position titles, and supervisors for the two previous periods of employment on the lines below that information.

Month/Year	Month/Year	Code	Employer/Verifier Name/Military Duty Location	Your Position Title/Military Rank		
<b>#1</b>						
Month/Year	Month/Year					
To	Present					
Employer's/Verifier's Street Address			City (Country)	State	ZIP Code	Telephone Number ( )
Street Address of Job Location (if different than Employer's Address)			City (Country)	State	ZIP Code	Telephone Number ( )
Supervisor's Name & Street Address (if different than Job Location)			City (Country)	State	ZIP Code	Telephone Number ( )
<b>PREVIOUS PERIODS OF ACTIVITY</b> (Block #1)	Month/Year	Month/Year	Position Title	Supervisor		
	To					
	Month/Year	Month/Year	Position Title	Supervisor		
To						
Month/Year	Month/Year					
To						
<b>#2</b>						
Month/Year	Month/Year					
To						
Employer's/Verifier's Street Address			City (Country)	State	ZIP Code	Telephone Number ( )
Street Address of Job Location (if different than Employer's Address)			City (Country)	State	ZIP Code	Telephone Number ( )
Supervisor's Name & Street Address (if different than Job Location)			City (Country)	State	ZIP Code	Telephone Number ( )
<b>PREVIOUS PERIODS OF ACTIVITY</b> (Block #2)	Month/Year	Month/Year	Position Title	Supervisor		
	To					
	Month/Year	Month/Year	Position Title	Supervisor		
To						
Month/Year	Month/Year					
To						
<b>#3</b>						
Month/Year	Month/Year					
To						
Employer's/Verifier's Street Address			City (Country)	State	ZIP Code	Telephone Number ( )
Street Address of Job Location (if different than Employer's Address)			City (Country)	State	ZIP Code	Telephone Number ( )
Supervisor's Name & Street Address (if different than Job Location)			City (Country)	State	ZIP Code	Telephone Number ( )
<b>PREVIOUS PERIODS OF ACTIVITY</b> (Block #3)	Month/Year	Month/Year	Position Title	Supervisor		
	To					
	Month/Year	Month/Year	Position Title	Supervisor		
To						
Month/Year	Month/Year					
To						

Enter your Social Security Number before going to the next page

**YOUR EMPLOYMENT ACTIVITIES (CONTINUED)**

<b>#4</b>	Month/Year To	Month/Year	Code	Employer/Verifier Name/Military Duty Location	Your Position Title/Military Rank		
Employer's/Verifier's Street Address				City (Country)	State	ZIP Code	Telephone Number ( )
Street Address of Job Location (if different than Employer's Address)				City (Country)	State	ZIP Code	Telephone Number ( )
Supervisor's Name & Street Address (if different than Job Location)				City (Country)	State	ZIP Code	Telephone Number ( )
<b>PREVIOUS PERIODS OF ACTIVITY (Block #4)</b>	Month/Year To	Month/Year	Position Title		Supervisor		
	Month/Year To	Month/Year	Position Title		Supervisor		
	Month/Year To	Month/Year	Position Title		Supervisor		

<b>#5</b>	Month/Year To	Month/Year	Code	Employer/Verifier Name/Military Duty Location	Your Position Title/Military Rank		
Employer's/Verifier's Street Address				City (Country)	State	ZIP Code	Telephone Number ( )
Street Address of Job Location (if different than Employer's Address)				City (Country)	State	ZIP Code	Telephone Number ( )
Supervisor's Name & Street Address (if different than Job Location)				City (Country)	State	ZIP Code	Telephone Number ( )
<b>PREVIOUS PERIODS OF ACTIVITY (Block #5)</b>	Month/Year To	Month/Year	Position Title		Supervisor		
	Month/Year To	Month/Year	Position Title		Supervisor		
	Month/Year To	Month/Year	Position Title		Supervisor		

<b>#6</b>	Month/Year To	Month/Year	Code	Employer/Verifier Name/Military Duty Location	Your Position Title/Military Rank		
Employer's/Verifier's Street Address				City (Country)	State	ZIP Code	Telephone Number ( )
Street Address of Job Location (if different than Employer's Address)				City (Country)	State	ZIP Code	Telephone Number ( )
Supervisor's Name & Street Address (if different than Job Location)				City (Country)	State	ZIP Code	Telephone Number ( )
<b>PREVIOUS PERIODS OF ACTIVITY (Block #6)</b>	Month/Year To	Month/Year	Position Title		Supervisor		
	Month/Year To	Month/Year	Position Title		Supervisor		
	Month/Year To	Month/Year	Position Title		Supervisor		

<b>12 YOUR EMPLOYMENT RECORD</b>	Yes	No
Has any of the following happened to you in the last 7 years? If "Yes," begin with the most recent occurrence and go backward, providing date fired, quit, or left, and other information requested.		

Use the following codes and explain the reason your employment was ended:

- |  |  |  |
|--|--|--|
| 1 - Fired from a job                           | 3 - Left a job by mutual agreement following allegations of misconduct                 | 5 - Left a job for other reasons under unfavorable circumstances |
| 2 - Quit a job after being told you'd be fired | 4 - Left a job by mutual agreement following allegations of unsatisfactory performance |  |

Month/Year	Code	Specify Reason	Employer's Name and Address (Include city/Country if outside U.S.)	State	ZIP Code

Enter your Social Security Number before going to the next page



<b>16 YOUR MILITARY HISTORY</b>	Yes	No
	<b>a</b> Have you served in the United States military?	
<b>b</b> Have you served in the United States Merchant Marine?		

List all of your military service below, including service in Reserve, National Guard, and U.S. Merchant Marine. Start with the most recent period of service (#1) and work backward. If you had a break in service, each separate period should be listed.

•**Code.** Use one of the codes listed below to identify your branch of service:

1 - Air Force    2 - Army    3 - Navy    4 - Marine Corps    5 - Coast Guard    6 - Merchant Marine    7 - National Guard

•**O/E.** Mark "O" block for Officer or "E" block for Enlisted.

•**Status.** "X" the appropriate block for the status of your service during the time that you served. If your service was in the National Guard, do not use an "X"; use the two-letter code for the state to mark the block.

•**Country.** If your service was with other than the U.S. Armed Forces, identify the country for which you served.

Month/Year	Month/Year	Code	Service/Certificate No.	Status				Country
				O	E	Active	Active Reserve	
To								
To								

<b>17 YOUR SELECTIVE SERVICE RECORD</b>	Yes	No
	<b>a</b> Are you a male born after December 31, 1959? If "No," go to 18. If "Yes," go to b.	
<b>b</b> Have you registered with the Selective Service System? If "Yes," provide your registration number. If "No," show the reason for your legal exemption below.		

Registration Number                      Legal Exemption Explanation

<b>18 YOUR INVESTIGATIONS RECORD</b>	Yes	No
	<b>a</b> Has the United States Government ever investigated your background and/or granted you a security clearance? If "Yes," use the codes that follow to provide the requested information below. If "Yes," but you can't recall the investigating agency and/or the security clearance received, enter "Other" agency code or clearance code, as appropriate, and "Don't know" or "Don't recall" under the "Other Agency" heading, below. If your response is "No," or you don't know or can't recall if you were investigated and cleared, check the "No" box.	

<b>Codes for Investigating Agency</b> 1 - Defense Department 2 - State Department 3 - Office of Personnel Management 4 - FBI 5 - Treasury Department 6 - Other (Specify)	<b>Codes for Security Clearance Received</b> 0 - Not Required 1 - Confidential 2 - Secret 3 - Top Secret 4 - Sensitive Compartmented Information 5 - Q 6 - L 7 - Other
--	--

Month/Year	Agency Code	Other Agency	Clearance Code	Month/Year	Agency Code	Other Agency	Clearance Code

<b>b</b> To your knowledge, have you ever had a clearance or access authorization denied, suspended, or revoked, or have you ever been debarred from government employment? If "Yes," give date of action and agency. <b>Note:</b> An administrative downgrade or termination of a security clearance is not a revocation.	Yes	No

Month/Year	Department or Agency Taking Action	Month/Year	Department or Agency Taking Action

<b>19 FOREIGN COUNTRIES YOU HAVE VISITED</b>	Yes	No
List foreign countries you have visited, except on travel under official Government orders, beginning with the most current (#1) and working back 7 years. (Travel as a dependent or contractor must be listed.)		

•Use one of these codes to indicate the purpose of your visit: 1 - Business    2 - Pleasure    3 - Education    4 - Other

•Include short trips to Canada or Mexico. If you have lived near a border and have made short (one day or less) trips to the neighboring country, you do not need to list each trip. Instead, provide the time period, the code, the country, and a note ("Many Short Trips").

•Do not repeat travel covered in items 9, 10, or 11.

Month/Year	Month/Year	Code	Country	Month/Year	Month/Year	Code	Country
#1	To			#5	To		
#2	To			#6	To		
#3	To			#7	To		
#4	To			#8	To		

Enter your Social Security Number before going to the next page ➔

<b>20 YOUR POLICE RECORD</b> <i>(Do not include anything that happened before your 16th birthday.)</i>					Yes	No
In the last 7 years, have you been arrested for, charged with, or convicted of any offense(s)? (Leave out traffic fines of less than \$150.)						
If you answered "Yes," explain your answer(s) in the space provided.						
Month/Year	Offense	Action Taken	Law Enforcement Authority or Court <i>(City and county/country if outside the U.S.)</i>	State	ZIP Code	

<b>21 ILLEGAL DRUGS</b>					Yes	No
The following questions pertain to the illegal use of drugs or drug activity. You are required to answer the questions fully and truthfully, and your failure to do so could be grounds for an adverse employment decision or action against you, but neither your truthful responses nor information derived from your responses will be used as evidence against you in any subsequent criminal proceeding.						
<b>a</b> In the last year, have you <u>illegally</u> used any controlled substance, for example, marijuana, cocaine, crack cocaine, hashish, narcotics (opium, morphine, codeine, heroin, etc.), amphetamines, depressants (barbiturates, methaqualone, tranquilizers, etc.), hallucinogenics (LSD, PCP, etc.), or prescription drugs?						
<b>b</b> In the last 7 years, have you been involved in the illegal purchase, manufacture, trafficking, production, transfer, shipping, receiving, or sale of any narcotic, depressant, stimulant, hallucinogen, or cannabis, for your own intended profit or that of another?						
If you answered "Yes" to "a" above, provide information relating to the types of substance(s), the nature of the activity, and any other details relating to your involvement with illegal drugs. Include any treatment or counseling received.						
Month/Year	Month/Year	Controlled Substance/Prescription Drug Used	Number of Times Used			
To						
To						
To						

<b>22 YOUR FINANCIAL RECORD</b>					Yes	No
<b>a</b> In the last 7 years, have you, or a company over which you exercised some control, filed for bankruptcy, been declared bankrupt, been subject to a tax lien, or had legal judgment rendered against you for a debt? If you answered "Yes," provide date of initial action and other information requested below.						
Month/Year	Type of Action	Name Action Occurred Under	Name/Address of Court or Agency Handling Case	State	ZIP Code	
<b>b</b> Are you now over 180 days delinquent on any loan or financial obligation? Include loans or obligations funded or guaranteed by the Federal Government.					Yes	No
If you answered "Yes," provide the information requested below:						
Month/Year	Type of Loan or Obligation and Account #	Name/Address of Creditor or Oblige	State	ZIP Code		

After completing this form and any attachments, you should review your answers to all questions to make sure the form is complete and accurate, and then sign and date the following certification and sign and date the release on Page 8.

**Certification That My Answers Are True**

My statements on this form, and any attachments to it, are true, complete, and correct to the best of my knowledge and belief and are made in good faith. I understand that a knowing and willful false statement on this form can be punished by fine or imprisonment or both. (See section 1001 of title 18, United States Code).

Signature <i>(Sign in ink)</i>	Date

**Enter your Social Security Number before going to the next page**

## UNITED STATES OF AMERICA

### AUTHORIZATION FOR RELEASE OF INFORMATION

Carefully read this authorization to release information about you, then sign and date it in ink.

**I Authorize** any investigator, special agent, or other duly accredited representative of the authorized Federal agency conducting my background investigation, to obtain any information relating to my activities from individuals, schools, residential management agents, employers, criminal justice agencies, credit bureaus, consumer reporting agencies, collection agencies, retail business establishments, or other sources of information. This information may include, but is not limited to, my academic, residential, achievement, performance, attendance, disciplinary, employment history, criminal history record information, and financial and credit information. I authorize the Federal agency conducting my investigation to disclose the record of my background investigation to the requesting agency for the purpose of making a determination of suitability or eligibility for a security clearance.

**I Understand** that, for financial or lending institutions, medical institutions, hospitals, health care professionals, and other sources of information, a separate specific release will be needed, and I may be contacted for such a release at a later date. Where a separate release is requested for information relating to mental health treatment or counseling, the release will contain a list of the specific questions, relevant to the job description, which the doctor or therapist will be asked.

**I Further Authorize** any investigator, special agent, or other duly accredited representative of the U.S. Office of Personnel Management, the Federal Bureau of Investigation, the Department of Defense, the Defense Investigative Service, and any other authorized Federal agency, to request criminal record information about me from criminal justice agencies for the purpose of determining my eligibility for assignment to, or retention in a sensitive National Security position, in accordance with 5 U.S.C. 9101. I understand that I may request a copy of such records as may be available to me under the law.

**I Authorize** custodians of records and other sources of information pertaining to me to release such information upon request of the investigator, special agent, or other duly accredited representative of any Federal agency authorized above regardless of any previous agreement to the contrary.

**I Understand** that the information released by records custodians and sources of information is for official use by the Federal Government only for the purposes provided in this Standard Form 85P, and that it may be redisclosed by the Government only as authorized by law.

Copies of this authorization that show my signature are as valid as the original release signed by me. This authorization is valid for five (5) years from the date signed or upon the termination of my affiliation with the Federal Government, whichever is sooner.

Signature ( <i>Sign in ink</i> )		Full Name ( <i>Type or Print Legibly</i> )		Date Signed
Other Names Used				Social Security Number
Current Address ( <i>Street, City</i> )		State	ZIP Code	Home Telephone Number ( <i>Include Area Code</i> ) (     )

## UNITED STATES OF AMERICA

### AUTHORIZATION FOR RELEASE OF MEDICAL INFORMATION

Carefully read this authorization to release information about you, then sign and date it in black ink.

#### Instructions for Completing this Release

This is a release for the investigator to ask your health practitioner(s) the three questions below concerning your mental health consultations. Your signature will allow the practitioner(s) to answer only these questions.

I am seeking assignment to or retention in a position of public trust with the Federal Government as a(n)

---

(Investigator instructed to write in position title.)

As part of the investigative process, **I hereby authorize** the investigator, special agent, or duly accredited representative of the authorized Federal agency conducting my background investigation, to obtain the following information relating to my mental health consultations:

Does the person under investigation have a condition or treatment that could impair his/her judgment or reliability?

If so, please describe the nature of the condition and the extent and duration of the impairment or treatment.

What is the prognosis?

I understand that the information released pursuant to this release is for use by the Federal Government only for purposes provided in the Standard Form 85P and that it may be redisclosed by the Government only as authorized by law.

Copies of this authorization that show my signature are as valid as the original release signed by me. This authorization is valid for 1 year from the date signed or upon termination of my affiliation with the Federal Government, whichever is sooner.

Signature ( <i>Sign in ink</i> )		Full Name ( <i>Type or Print Legibly</i> )		Date Signed
Other Names Used				Social Security Number
Current Address ( <i>Street, City</i> )		State	ZIP Code	Home Telephone Number ( <i>Include Area Code</i> ) (      )

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**10/02; Rev 01/03**

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## SECTION 01040

AS-BUILT DRAWINGS  
10/02; Rev 01/03

## PART 1 GENERAL

## 1.1 DEFINITIONS

The definitions listed below form a part of this specification.

## 1.1.1 Red-Line Drawings

Contract drawings marked-up to show actual work performed to include necessary sketches, modification drawings, shop drawings and notes. Green ink is used to indicate work deleted from the contract. Red ink is used for additions and deviations from the contract.

## 1.1.2 As-Built Drawings

Professional finished vellum drawings and electronic CADD files developed from the original contract drawings that include all of the information from the redline drawings and suitable for half-size reproduction.

## 1.1.3 Vellum Drawings

Drawings on erasable Vellum 20# similar or equal to Xerox Zero solvent vellum.

## 1.1.4 Black-Line Drawings

Paper drawings reproduced from electronic CADD files or high quality reproducible drawings.

## 1.1.5 Full-Size Drawings

28 inches x 40 inches nominal size drawings with all details visually readable.

## 1.1.6 Half-Size Drawings

14 inches x 20 inches nominal size drawings with all details visually readable.

## 1.1.7 Modification Circle

A circle with a horizontal line through the center. The top half will contain the letter "P" with the bottom half containing the Modification number. The lettering standard will be 120/6 WRICO or similar.

## 1.1.8 Mylar Drawings

Drawings on polyester film, 3 or 5 mil, similar or equal to K & E Stabilene.

## 1.1.9 Electronic CADD Files

Electronic CADD files are files saved on CD-ROM in accordance with appropriate CADD standard. The CADD standard will include level on/off status, special characters, line weights, font, and size requirements.

## 1.2 GENERAL REQUIREMENTS

The work includes creation of vellum drawings and electronic CADD files on Microstation SE for as-built drawings to accurately depict existing conditions of the project. As-Built Drawings will become the permanent record drawings of the construction. The Contractor is responsible for development of electronic CADD files in accordance with Omaha District CADD standards Omaha District Microstation CADD Standards, which includes Microstation and Adobe Acrobat files regarding blocks, cells, fonts, standard drawings and standards, will be made available to the successful bidder. See requirements in this section and folder on solicitation CD-ROM labeled "CADDSTD" file named "CADDSTD.PDF" for a summary of Omaha District Microstation file requirements. The Contractor shall be responsible for furnishing the required CAD software. The Omaha District will furnish a CD of CAD (read-write) contract drawing files in the software language specified in paragraph Procedure below. This is the software language required by the Using Service. These drawing files shall be used to prepare required As-Built drawings. The As-Built drawings shall include all major features of the work and all details to the same level as the original contract set of drawings. All changes from the contract drawings, including but not limited to all deviations, additional information, and modifications to the contract. Where contract drawings or specifications allow for options, only the option selected and actually constructed shall be shown on the As-Built Drawings. Systems designed or enhanced by the Contractor such as HVAC control system, fire alarm system fire sprinkler system, irrigation sprinkler system, letters of clarification, shall be accurately and neatly recorded on the As-Built Drawings using the same symbols, terminology, and general quality as the original set of contract drawings. All sheets affected by a change shall be revised. The transmittal requirements for the As-built Drawings shall be shown as events on the Contractor prepared project schedule.

## 1.3 PAYMENT

In accordance with the clause "Payment Under Fixed - Price Construction Contracts", which provides for progress payments on estimates of work accomplished (which meets the standards of quality established under the contract), \$100,000 will be withheld from payment for the creation of As-Built drawings until the final as-built drawings are delivered to the Contracting Officer (including any necessary revisions and subject to the approval of the Contracting Officer).

The Government will assign the Contractor a performance rating (CCASS for Corps of Engineers projects) upon completion of the project. The timeliness of satisfactory As-Built drawing submittals will be an important factor in determining the assigned rating. An unsatisfactory performance of As-Built drawings creation will be given to the Contractor if the Contractor demonstrates an unwillingness to work with the Government on As-Built drawing creation or the Contractor fails to submit satisfactory Final As-Built drawings within 60 calendar days of turning the completed project over to the Using Service.

## 1.4 TRANSMITTAL OF AS-BUILT DRAWINGS

### 1.4.1 Preliminary As-Built Drawings

The Contractor shall produce Preliminary As-Built Drawings indicating as-built conditions on Microstation SE with "clouding". The Contractor shall contact Jim Janicek at (402)221-4519 before beginning As-Built preparation. As-Built preparation process is provided in paragraph As-Built Preparation below. Preliminary drawings shall consist of 15 percent of total project drawings. These drawings shall be sheets used for the construction of this project (excludes Cover Sheet, Vicinity Map, Location Plan and Indexes). The As-Built CADD files which include all changes up to the time Preliminary Drawings shall be sent as stated below. The Contractor shall draw attention to all drawing changes by "clouding" the affected area. This "clouding" shall be accomplished on layer 63 of the drawing file. The Preliminary Drawings shall consist of one (1) set of CADD files on a CD-ROM and one (1) full-size set of the Black-Line Drawings. One (1) set of CADD files on a CD-ROM shall be submitted to the Omaha District Office (ATTN: CENWO-ED-DI, Jim Janicek). One (1) full-size set of the Black-Line Drawings shall be submitted to the COR. Both documents shall be submitted three (3) weeks prior to the final acceptance inspection unless otherwise directed by the COR. The COR will notify the Contractor in writing of approval / disapproval. The Contractor shall not submit the Final Drawings until he receives the COR's letter approving the Preliminary Drawings.

#### 1.4.2 Final As-Built Drawings

The Contractor shall produce Final As-Built Drawings on Microstation SE without "clouding". As-Built preparation process is provided in paragraph As-Built Preparation below. The Final Drawings shall include all changes. The Final Drawings in the form of a CD-ROM shall be submitted to the COR and Omaha District Office (CENWO-ED-DI) no earlier than the day of acceptance of the project and no later than thirty (30) days after the date on the acceptance letter for the Preliminary Drawing unless otherwise directed by the COR. (Note: Final drawings shall not be forwarded to the customer. Corps of Engineers, Omaha District COR will forward to the customer after Quality Review.) Contractor shall submit one (1) set of CADD files on a CD-ROM to the Omaha District Office (ATTN: CENWO-ED-DI, Jim Janicek). Contractor shall send the following documents to the COR:

a) One (1) set of CADD files on CD-ROM (folder name containing as-built files shall be designated "AS-BUILTS" on each CD-ROM). Both CD case and CD-ROM shall contain the name of the project, location, specification number, and contract number, and words "As-Built Record Set"). The folder shall contain drawings, indexes and X-REF files related to all as-builts.

b) One (1) full-size set of vellum As-Built Drawings, along with all red-lined hard copy drawings prepared by the Contractor during construction.

COR will forward one (1) full-size set of drawings along with CD-ROM to the customer.

#### 1.4.3 As-Built Preparation

Both preliminary and final electronic as-built drawings shall be produced in accordance with the following process for MicroStation drawings:

##### 1.4.3.1 For Microstation (\*.DGN) Files

a. When opened, the drawing shall be seen exactly as it should be

plotted.

- b. Only one view port is open in the file.
- c. The view shall be zoomed to fit the border.
- d. All information in the title block shall be filled in, including plot scale.
- e. The information in the title block shall be correct, including the design file name and the plot scale.
- f. All files shall reference a MicroStation border supplied by the Omaha District.
- g. Detach all unused reference files.
- h. For any half tone references, the logical name shall have common first or last character(s). Preferably use "\_xxx" at the end of the logical name. Include this information with the pertinent information.
- i. All unnecessary information outside the border shall be deleted.
- j. All files shall be compressed.
- k. The font resource file used shall be included with the set, even if it is the standard MicroStation font resource.
- l. An ASCII text file shall be provided with the following information:  
reference file paths that should be added to MS\_RFDIR, the name of your font resource file, the name and phone number of the person we need to contact if we have problems, and the version of MicroStation used to create and/or work on the drawings.

#### 1.5 PROCEDURE

One (1) CD-ROM containing the contract drawings (read-write CADD files) and CADD standards in Microstation SE format, for use in the preparation of As-Built Drawings by the Contractor, will be forwarded to the Resident Engineer. This CD-ROM will then be furnished to the Contractor after signed receipt to the Resident Engineer. The Contractor shall create a set of electronic CADD files and full-size Red-Line Drawings to fully indicate As-Built conditions. The Red-Line Drawings shall be maintained at the site, in a current condition until the completion of the work and shall be available for review by the COR at all times. All as-built conditions shall be on the Red-Line Drawings within two (2) days after the work activity is completed or shall be entered on the deficiency tracking system (see Section 01451A, CONTRACTOR QUALITY CONTROL). The Contractor shall not convert electronic drawing files from one software language to another (i.e. Microstation to AutoCADD or AutoCADD to Microstation).

#### 1.6 TITLE BLOCKS

The contract number and the specification number (if available) shall be shown on all sheets. "RECORD DRAWING" shall be added below the title block on all sheets. All modifications to the contract shall be posted in ascending order. The top line of the revision box shall state "REVISED TO SHOW AS-BUILT CONDITIONS" and dated. All modifications to all plans, sections, or details, shall have a modification number placed in the revision box under column entitled "Symbol". The statement "GENERAL REVISIONS" may be used when applicable. The date to be added in the revision box for modifications is found in Block 3 of Form SF-30. Cover Sheet will have Contract Award Set changed to As-Built Record Set with month & year completed. Month and year completed will also go in the date box in the title block. There will be no separate dates.

#### 1.7 PROCEDURES FOR POSTING MODIFICATION CHANGES TO DRAWINGS

Follow directions in the modification for posting descriptive changes.

A Modification Circle shall be placed at the location of each deletion. The highest modification number on the sheet should be shown in the modification circle in the "DATE" and "DRAWING CODE" boxes of the title block.

For all new details or sections that are added to a drawing, place a Modification Circle by the detail or section title.

For changes to a drawing, place a Modification Circle by the title of the affected plan, section or detail titles (each location).

For changes to schedules on drawings, a Modification Circle shall be placed either by the schedule heading or by the change in the schedule.

The Modification Circle size shall be 1/2-inch diameter unless the area where circle is to be placed is crowded. Use smaller size circle for crowded areas.

#### 1.8 WORD ABBREVIATIONS

Abbreviations shown on the abbreviation sheet shall be used to describe all work items. Additional word abbreviations, not found on the abbreviation sheet but necessary to describe the work, shall be properly identified and incorporated with the other standard word abbreviations.

#### 1.9 LEGEND SHEETS

Symbols, which conflict with those on the original contract legend sheet, shall not be used. Additional symbols, necessary to depict any additional work items, shall be properly identified and added to the legend sheet or supplemental legend. Those projects that do not have legend sheets may use supplemental legends on each sheet where symbol is shown.

#### 1.10 CONTRACTOR SHOP DRAWINGS

Contractor shop drawings, which supersede data on the contract plans and/or additional drawings, prepared by the Contractor, shall be incorporated into the As-Built Drawings. Design plans prepared by Contractor shall include the designer's name on the As-Built Drawings.

#### 1.11 INDEXING OF DRAWINGS

If drawings are added to the portfolio of drawings to depict as-built conditions, the index of drawings shall be revised accordingly.

### PART 2 PRODUCTS (NOT APPLICABLE)

### PART 3 EXECUTION

#### 3.1 GENERAL

As-Built drawings shall include as-built information to the same level of detail as shown on the original details, unless otherwise specified. The Contractor shall provide any additional full-size drawings as required to display all the details.

#### 3.2 SITE WORK

##### 3.2.1 Utilities

All utilities shall be shown whether active, inactive, shown on the original contract drawings, or found on-site. The type of utility,

location, general direction, size, material make-up and depth shall be shown. The location and description of any utility line or other installations of any kind known to exist within the construction area shall be shown. The location shall include dimensions to permanent features.

### 3.2.2 Structures

Structures above and below ground shall be shown. The size, material make-up, location, height, and/or depth shall be shown. Manholes shall show rim elevation and invert elevations as applicable. Power poles shall show electrical equipment and voltage rating.

### 3.2.3 Grades

Grade or alignment of roads, structures, or utilities shall be corrected if any changes were made from the contract drawings. Elevations shall be corrected if changes were made in site grading.

## 3.3 STRUCTURAL

### 3.3.1 Steel

Shop drawings that deviate from the contract drawings shall be incorporated in the As-Built Drawings.

## 3.4 MECHANICAL

### 3.4.1 Ductwork

Ductwork shall be shown to reflect actual installation and duct size. Ductwork routing changes shall be shown.

### 3.4.2 Plumbing

Piping and fixtures shall be shown to reflect the type of material, size and the route or location.

## 3.5 ELECTRICAL

### 3.5.1 Panels

All contract drawing panel schedules shall be revised to show as-built conditions. Home-run circuit designation on electrical drawings shall accurately correspond to the as-built panel schedules.

### 3.5.2 Controls

All control diagrams in contract drawings shall be revised to reflect as-built conditions, and setpoints.

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## SECTION 01200

CONSTRUCTION GENERAL  
5/00; Rev 01/02

## PART 1 GENERAL

## 1.1 SCOPE

The work covered in this section is outlined as a statement of construction requirements common to all the work. Specific requirements for materials and installations are provided under the Technical Sections herewith. No claims for extras shall be made on account of items presumed to have been omitted from this section.

## 1.2 CONSTRUCTION RIGHT-OF-WAY

The Contractor will be assigned working areas or working right-of-way limits for use in the prosecution of work under this contract, subject to the CONTRACT CLAUSES clause entitled "Operations and Storage Areas."

## 1.3 PROTECTION OF EXISTING FACILITIES AND WORKS

The Contractor shall be responsible for the protection of the work area from damage and upon completion of the work shall leave existing works in a condition equal to that which existed when the work started. All work, storage of materials, and construction plant shall be kept within the limits of the areas assigned. Prior to construction operations, the Contractor shall confer with the Contracting Officer's representative to determine the proximity of any possible under-ground obstructions, pipe or equipment which could be damaged as a result of construction operations. Existing utility lines that are shown on the drawings or the locations are otherwise made known to the Contractor shall be protected from damage, and if damaged, shall be repaired by the Contractor at no additional expense to the Government. In the event that the Contractor damages any existing utility lines that are not shown or the locations of which have not been made known to the Contractor, report thereof shall be made immediately to the Contracting Officer. If the Contracting Officer determines that repairs shall be made by the Contractor, such repairs will be ordered under CONTRACT CLAUSES clause entitled "Changes." The Contractor will be responsible for the protection of structures from any structural damage during the construction operations. Roads and surfaces shall be protected from damage by the work or if damaged shall be repaired with equal materials at no additional expense to the Government. At all times the plant and work areas shall be kept in a condition conducive to safety of workmen and the public and neat in appearance. Waste or surplus materials shall not be allowed to accumulate in the construction areas.

## 1.3.1 Protection of Appurtenances from Bituminous Material Applications

It shall be the responsibility of the Contractor to cover and protect the surfaces of roadway appurtenances, structures and installations by approved methods in advance of any bituminous material application adjacent thereto.

Damages or defacement thereof shall be corrected as directed, by and at the expense of the Contractor.

### 1.3.2 Interruption of Electric Power

If it is necessary to cut off power in transmission lines that pass through construction areas, it shall be the Contractor's responsibility to make the necessary arrangements with the owner of the powerline, and the Contractor shall pay all costs therefor.

### 1.3.3 Flood Protection Works

In all cases where materials in the existing flood protection works are used or connected with the construction of new work under this contract, the work shall be so planned and executed that the new work shall be completed to provide protection equivalent to the existing protection as the existing protection is weakened or removed. These operating restrictions shall be followed in order that the new work may be tied in, or connected promptly, by the Contractor, with the existing facilities so as to furnish a continuous service in an emergency. These ties or connections shall be made during periods of suspended construction operations and the Contractor shall leave incompletd pipe outlets and other structures in such conditions as to not interfere with the natural drainage from areas served by these pipes or structures.

## 1.4 CARE OF WATER

Full responsibility for care of water shall be borne by the Contractor until completion of work under this contract. The Contractor shall provide the materials and equipment and perform all work necessary to facilitate construction and to protect the work from damage by water. The Contractor shall make his own investigations and determinations of conditions, both existing and anticipated concerning care of water. Plans for care of water are subject to approval by the Contracting Officer prior to construction. Facilities shall be removed upon completion of the work.

## 1.5 DRAINAGE

The Contractor shall provide and maintain ditches, dikes, and other facilities within and adjacent to the work areas, to divert water from surface and subsurface flow away from work in place or under construction by this and other contracts to prevent damage and interference. The basis for design, location, type and size of drainage facilities are subject to review and approval prior to construction.

## 1.6 DISPOSITION OF CONSTRUCTION FACILITIES

All buildings and facilities constructed by the Contractor shall be maintained in a satisfactory condition with strict observance of the rules of sanitation, safety and order as may be established by the Contracting Officer. Prior to final payment under the contract, all buildings and facilities constructed by the Contractor for his own use shall be removed from the site by the Contractor.

## 1.7 ACCESS ROADS AND HAUL ROADS

### 1.7.1 Access Roads

Access roads as required for the prosecution of the work shall be maintained (including sprinkling for dust control, safety personnel, signals and control) within the work areas assigned to the Contractor.

Consideration shall be given to the avoidance of interference with others, safety and frequency of traffic, subject to review and approval prior to construction. Access road areas shall be restored to their original or suitable condition upon completion of this contract. The Contractor shall be responsible for repair of damage to existing roads caused by his operation.

#### 1.7.2 Haul Roads

The Contractor shall construct haul roads as may be necessary for the conduct of the work without additional cost to the Government. The Contractor shall arrange his hauling operations so as to cause a minimum interference with traffic and shall furnish flagmen and other facilities as required to avoid additional hazards to the public. Lines, grades and widths for haul roads, shall be selected to fulfill the requirements for safe and efficient hauling operations and shall be approved by the Contracting Officer prior to construction. Haul roads shall have ample width to provide safety. Preference shall be given to one-way haul roads when these are feasible. All roads shall be maintained in first class condition during all periods of their use. Roads shall be sprinkled whenever, in the opinion of the Contracting Officer, control of dust is necessary to insure safe movements of construction traffic. Upon completion of work under this contract, roads shall be disposed of as directed by the Contracting Officer. All signs, culverts, guards, fences and other improvements on roads constructed for the Contractor's convenience and operations shall be removed from the project site and shall remain his property. Use and repair of existing roads and bridges shall be subject to the requirements of local authorities. Prior to start of hauling operations on public roads, the Contractor shall furnish written evidence to the Contracting Officer that an agreement has been consummated with State and County officials on the use of public roads and bridges. Such agreements shall clearly relieve the Government of any responsibility for damage resulting from hauling across or on these roads.

#### 1.7.3 Joint Use of Transportation Facilities

The Contractor may use jointly with contractors and others, existing access and haul roads constructed by the Government or by others. Unless otherwise specifically authorized in writing, the Contractor will not be granted exclusive use of any access or haul road whether it be an existing road or one constructed by the Contractor. However, the use by others of roads constructed by or assigned to the Contractor primarily for his own use will be limited by the Contracting Officer to the minimum considered consistent with efficient prosecution of the work under this and other contracts in force. Maintenance of jointly used facilities shall be shared in proportion to use. In the event of a disagreement between this Contractor and others as to the use of any road, the decision of the Contracting Officer shall be final. The Contractor shall not obstruct any existing road on the land controlled by the Government.

### 1.8 PUBLIC ROADS

#### 1.8.1 Traffic Control

The Contractor shall be responsible for the safe control of traffic on all haul and access roads used primarily for the work under these specifications and at their crossings with roads used by others. The Contractor shall, at his own expense, furnish all personnel, signal devices and signal necessary for the safe and efficient control of construction

traffic on road systems used by the Contractor. A plan for traffic control, including a listing of equipment and its employment, shall be submitted for review and approval prior to construction.

#### 1.8.2 Operations

When operations are being conducted near a U. S. or State Highway or when construction equipment is being used on or adjacent to such highway, the Contractor shall furnish signalmen and such warning signs as are necessary to provide adequate warning to the traveling public in accordance with applicable State and Local laws and regulations. The highways and streets shall be kept open at all times.

#### 1.8.3 State and Federal Highways

Where the Contractor hauls across or on State or Federal highways, he shall enter into all agreements with the State Highway Commission and shall comply with any restrictions they may impose relative to load limits, care of traffic and cleanup. Such agreements shall clearly relieve the Government of any responsibility for damages resulting from hauling across or on State highways. Copies of such agreements shall be furnished to the Contracting Officer before the Contractor begins hauling on these highways.

#### 1.8.4 State and Local Public Roads

##### (a) Load Limits:

The Montana Highway Commission and local County Road Commissions restrict the load weights of haul vehicles using highways and county roads during the spring thaw period. The load restrictions are usually imposed from 1 April through June depending on actual weather conditions.

##### (b) Hauling Regulations:

Prior to start of hauling operations on public roads, the Contractor shall furnish evidence to the Contracting Officer that an agreement has been consummated with State and County officials on the use of public roads and bridges. Such agreements shall clearly relieve the Government of any responsibility for damage resulting from hauling across or on these roads.

#### 1.9 COOPERATION WITH OTHERS

The Contractor shall cooperate and coordinate his work with that of others as required for orderly completion of all work. In the event of disagreement between the Contractor and others, the decision of the Contracting Officer shall be final.

#### 1.10 WORK BY OTHERS

Public and private authorities may be working in the area during the life of this contract. The Contractor shall coordinate his work with others to avoid undue interference, and shall conduct his operations, other than required access, within the limits of the assigned construction area or construction right-of-way limits. Specifications and drawings showing work under other contracts are available for examination at the Corps of Engineers District Office, 215 North 17th Street, Omaha, Nebraska 68102-4978, or at the Office of the Area Engineer.

#### 1.11 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Proposed Methods of Operation; G-AO

Progress Charts; G-AO

Construction Right-of-Way

Right-of-Way Agreements

State and Federal Highways

Agreements for hauling on highways

State and Local Public Roads

Agreements for hauling on roads

SD-02 Shop Drawings

Care of Water; G-AO

Traffic Control; G-AO

SD-11 Closeout Submittals

Warranty of Construction

List of warranties with copy of each

Equipment Warranty Booklet

1.12 PROJECT SIGN

The Contractor shall provide a new project sign constructed in accordance with drawing sheet C1.05. The sign shall be erected at the project site by the Contractor at the location determined by the Contracting Officer. The project sign shall remain the property of the Contractor and upon completion of the contract, work shall be removed from the premises by the Contractor. No separate payment will be made for the sign.

1.13 SUPERVISION

All planting and maintenance of trees and shrubs shall be conducted under the supervision of a qualified forester or nurseryman. The supervisor must be a graduate from an accredited college or university in the field of forestry and have a minimum three years of tree planting experience or have equivalent experience in the field of forestry and nursery planting. The supervisor's qualifications will be subject to approval prior to beginning construction operations. The Contractor's supervisor shall be in attendance at all times work is being performed. In order to insure specified maintenance of trees and shrubs the supervisor shall report at

weekly intervals to the Contracting Officer during the period of 1 May to 15 October and as often thereafter as directed. If the specified maintenance is not performed satisfactorily within 7 days by the Contractor after being so directed and/or if the Contractor's qualified supervisor fails to report or appear on the specified date the Contracting Officer may within 7 days of such date, commence specified maintenance and the costs thereof will be deducted from future progress payments due the Contractor.

#### 1.14 PORTABLE TOILETS

Toilet facilities will not be available for Contractor's use. The Contractor shall provide and maintain portable toilets for use by the Contractor's staff. Toilet(s) shall be placed at the location directed by the Contracting Officer. To prevent overturning by high winds, all portable toilets shall be anchored down.

#### 1.15 WARRANTY OF CONSTRUCTION

(a) Foremost and in addition to any other warranties in this contract, the Contractor warrants, except as provided in paragraph (i) of this clause, that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier.

(b) This warranty shall continue for a period of 1 year from the date of final acceptance of the work. If the Government takes possession of any part of the work before final acceptance, this warranty shall continue for a period of 1 year from the date the Government takes possession.

(c) The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Government-owned or controlled real or personal property, when that damage is the result of--

(1) The Contractor's failure to conform to contract requirements;  
or

(2) Any defect of equipment, material, workmanship, or design furnished by the Contractor.

(d) The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause.

(e) The Contractor's warranty with respect to work restored, repaired or replaced will run for 1 year from the date of restoration, repair or replacement. This provision applies equally to all items restored, repaired, or replaced under paragraph (c) and (d) above.

(f) The Government will notify the Contractor, in writing, within a reasonable time after the discovery of any failure, defect, or damage. Repair work necessary to correct a warranty condition which arises to threaten the health or safety of personnel, the physical safety of property or equipment, or which impairs operations, habitability of living spaces, etc., will be performed by the Contractor on an immediate basis as directed verbally by the Government. Written verification will follow verbal instruction.

(g) If the Contractor fails to remedy any failure, defect, or damage within a reasonable time after receipt of verbal or written notice, the Government shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

(h) With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall--

(1) Obtain all warranties that would be given in normal commercial practice;

(2) Require all warranties to be executed, in writing, for the benefit of the Government, if directed by the Contracting Officer; and

(3) Enforce all warranties for the benefit of the Government, if directed by the Contracting Officer.

(i) In the event the Contractor's warranty under paragraph (b) of this clause has expired, the Government may bring suit at its expense to enforce a subcontractor's, manufacturer's, or supplier's warranty.

(j) Unless a defect is caused by the negligence of the Contractor or subcontractor or supplier at any tier, the Contractor shall not be liable for the repair of any defects of material or design furnished by the Government nor for the repair of any damage that results from any defect in Government-furnished material or design.

(k) This warranty shall not limit the Government's rights under the Inspection and Acceptance clause of this contract with respect to latent defects, gross mistakes, or fraud.

#### 1.16 ADDITIONAL WARRANTY REQUIREMENTS

##### 1.16.1 Performance Bond

(a) It is understood that the Contractor's Performance Bond will remain effective for one (1) year from the date of acceptance.

(b) If either the Contractor or his representative doesn't diligently pursue warranty work to completion, the contractor and surety will be liable for all costs. The Government, at its option, will either have the work performed by others or require the surety to have it done. Both direct and administrative costs will be reimbursable to the Government.

##### 1.16.2 Pre-Warranty Conference

(a) Prior to contract completion and at a time designated by the Contracting Officer or his authorized representative, the Contractor shall meet with the Contracting Officer or his authorized representative to develop a mutual understanding with respect to the requirements of the Paragraph: WARRANTY OF CONSTRUCTION. Communication procedures for Contractor notification of warranty defects, priorities with respect to the type of defect and other details deemed necessary by the Contracting Officer or his authorized representative for the execution of the construction warranty shall be

established/reviewed at this meeting.

(b) In connection with these requirements and at the time of the Contractor's quality control completion inspection, the Contractor will furnish the name, telephone number and address of the service representative which is authorized to initiate and pursue warranty work action on behalf of the Contractor and surety. This single point of contact will be located within the local service area of the warranted construction, will be continuously available, and will be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any Contractual responsibilities in connection with the paragraph: WARRANTY OF CONSTRUCTION.

(c) Local service area is defined as the area in which the contractor or his representative can meet the response times as described in paragraph 1.2.4 and in any event shall not exceed 200 miles radius of the construction site.

#### 1.16.3 Equipment Warranty Identification

The Contractor shall provide warranty identification tags on all mechanical and electrical equipment installed under this contract. Tags and installation shall be in accordance with the requirements of Paragraph: EQUIPMENT WARRANTY IDENTIFICATION TAGS.

#### 1.16.4 Warranty Service Calls

The Contractor or his local service representative will respond to the site, to a call within the time periods as follows: Four (4) hours for Heating, Air Conditioning, Refrigeration, Air Supply and Distribution, Critical Electrical service Systems and Food Service Equipment and Twenty-Four (24) hours For All Other Systems.

#### 1.16.5 Equipment Warranty Booklet

At or before 30 days prior to final inspection and acceptance of the work, the Contractor shall submit the data mentioned as follows:

The Contractor shall provided a Booklet, which consists of a listing of all equipment items (see paragraphs a. and b. below) which are specified to be guaranteed along with the warranty papers for each piece of equipment. Three (3) legible bound copies of the booklet shall be submitted for approval and shall be indexed alphabetically by equipment type. For each specific guaranteed item, the name, address, and telephone number shall be shown on the list for the subcontractor who installed equipment, equipment supplier or distributor, and equipment manufacturer. Completion date of the guarantee period shall correspond to the applicable specification requirements for each guaranteed item. The names of service representatives that will make warranty calls along with the day, night, weekend and holiday contacts for response to a call within the time period specified shall also be identified.

a. For Equipment in Place: The equipment list shall show unit retail value and nameplate data including model number, size, manufacturer, etc. This would include capital equipment and other nonexpendable supplies of a movable nature that are not affixed as an integral part of the facility and may be removed without destroying or reducing the usefulness of the facility. Some examples are spare parts, special tools, manufacturing

equipment, maintenance equipment, instruments, installed under this contract.

b. For Installed Building Equipment: The equipment list shall show unit retail value and nameplate data including model number, size, manufacturer, etc. This would include items of equipment and furnishings (including material for installation thereof), which are required to make the facility usable and are affixed as a permanent part of the structure. Some examples are plumbing fixtures, laboratory counters and cabinets, kitchen equipment, mechanical equipment, electrical equipment, and fire protection systems installed under this contract.

1.17 EQUIPMENT WARRANTY IDENTIFICATIONS TAGS

1.17.1 GENERAL REQUIREMENTS

The Contractor shall provide warranty identification tags on all Contractor and government furnished equipment which is Contractor installed.

1.17.1.1 Tags and Information

The tags and information shall be similar in format and size to the exhibits provided by this specification, and shall be suitable for interior and exterior locations, resistant to solvents, abrasion, and to fading caused by sunlight, precipitation, etc. These tags shall have a permanent pressure-sensitive adhesive back, and shall be installed in a position that is easily (or most easily) noticeable. If the equipment surface is not suitable for adhesive back, Contractor shall submit his alternative to the Contracting Officer's Authorized Representative for review and approval. Contractor furnished equipment that has differing warranties on its components will have each component tagged.

1.17.1.2 Tags for Warranted Equipment

The tag for his equipment shall be similar to the following:

```

+-----+
|                                     |
|               EQUIPMENT WARRANTY   |
|                                     |
|           CONTRACTOR FURNISHED EQUIPMENT |
|                                     |
| MFG-----MODEL NO.----- |
| SERIAL NO.----- |
| CONTRACT NO.----- |
| CONTRACTOR NAME----- |
| CONTRACTOR ADDRESS----- |
| CONTRACTOR TELEPHONE----- |
| CONTRACTOR WARRANTY EXPIRES----- |
| IN CASE OF WARRANTY ACTION FIRST CONTACT |
| [DEH] [BCE] AT [TELEPHONE NUMBER] |
|                                     |
+-----+
    
```



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SECTION 01320A

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## SECTION 01320A

PROJECT SCHEDULE  
08/01; Omaha Rev. 10/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of the specification to the extent referenced. The publications are referenced in the text by basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

ER 1-1-11 (1995) Progress, Schedules, and Network Analysis Systems

## 1.2 QUALIFICATIONS

The Contractor shall designate an authorized representative who shall be responsible for the preparation of all required project schedule reports.

## PART 2 PRODUCTS (Not Applicable)

## PART 3 EXECUTION

## 3.1 GENERAL REQUIREMENTS

Pursuant to the Contract Clause, SCHEDULE FOR CONSTRUCTION CONTRACTS, a Project Schedule as described below shall be prepared. The scheduling of construction shall be the responsibility of the Contractor. Contractor management personnel shall actively participate in its development. Subcontractors and suppliers working on the project shall also contribute in developing and maintaining an accurate Project Schedule. The approved Project Schedule shall be used to measure the progress of the work, to aid in evaluating time extensions, and to provide the basis of all progress payments. The scheduler shall be a direct employee of the prime contractor and have a minimum of 2 years experience in scheduling.

## 3.2 BASIS FOR PAYMENT

The schedule shall be the basis for measuring Contractor progress. Lack of an approved schedule or scheduling personnel will result in an inability of the Contracting Officer to evaluate Contractor's progress for the purposes of payment. Failure of the Contractor to provide all information, as specified below, shall result in the disapproval of the entire Project Schedule submission and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes. In the case where Project Schedule revisions have been directed by the Contracting Officer and those revisions have not been included in the Project Schedule, the Contracting Officer may hold retainage up to the maximum allowed by contract, each payment period, until revisions to the Project Schedule have been made.

## 3.3 PROJECT SCHEDULE

The computer software system utilized by the Contractor to produce the Project Schedule shall be capable of providing all requirements of this specification. Failure of the Contractor to meet the requirements of this specification shall result in the disapproval of the schedule. Manual methods used to produce any required information shall require approval by the Contracting Officer.

### 3.3.1 Use of the Critical Path Method

The Critical Path Method (CPM) of network calculation shall be used to generate the Project Schedule. The Contractor shall provide the Project Schedule in the Precedence Diagram Method (PDM).

### 3.3.2 Level of Detail Required

The Project Schedule shall include an appropriate level of detail. Failure to develop or update the Project Schedule or provide data to the Contracting Officer at the appropriate level of detail, as specified by the Contracting Officer, shall result in the disapproval of the schedule. The Contracting Officer will use, but is not limited to, the following conditions to determine the appropriate level of detail to be used in the Project Schedule:

#### 3.3.2.1 Activity Durations

Contractor submissions shall follow the direction of the Contracting Officer regarding reasonable activity durations. Reasonable durations are those that allow the progress of activities to be accurately determined between payment periods (usually less than 2 percent of all non-procurement activities' Original Durations are greater than 20 days).

#### 3.3.2.2 Procurement Activities

Tasks related to the procurement of long lead materials or equipment shall be included as separate activities in the project schedule. Long lead materials and equipment are those materials that have a procurement cycle of over 90 days. Examples of procurement process activities include, but are not limited to: submittals, approvals, procurement, fabrication, and delivery.

#### 3.3.2.3 Critical Activities

The following activities shall be listed as separate line activities on the Contractor's project schedule:

- a. Submission and approval of mechanical/electrical layout drawings.
- b. Submission and approval of O & M manuals.
- c. Submission and approval of as-built drawings.
- d. Submission and approval of 1354 data and installed equipment lists.
- e. Submission and approval of testing and air balance (TAB).
- f. Submission of TAB specialist design review report.
- g. Submission and approval of fire protection specialist.

h. Submission and approval of testing and balancing of HVAC plus commissioning plans and data.

i. Air and water balance dates.

j. HVAC commissioning dates.

k. Controls testing plan.

l. Controls testing.

m. Performance Verification testing.

n. Other systems testing, if required.

o. Prefinal inspection.

p. Correction of punchlist from prefinal inspection.

q. Final inspection.

#### 3.3.2.4 Government Activities

Government and other agency activities that could impact progress shall be shown. These activities include, but are not limited to: approvals, inspections, utility tie-in, Government Furnished Equipment (GFE) and Notice to Proceed (NTP) for phasing requirements.

#### 3.3.2.5 Responsibility

All activities shall be identified in the project schedule by the party responsible to perform the work. Responsibility includes, but is not limited to, the subcontracting firm, contractor work force, or government agency performing a given task. Activities shall not belong to more than one responsible party. The responsible party for each activity shall be identified by the Responsibility Code.

#### 3.3.2.6 Work Areas

All activities shall be identified in the project schedule by the work area in which the activity occurs. Activities shall not be allowed to cover more than one work area. The work area of each activity shall be identified by the Work Area Code.

#### 3.3.2.7 Modification or Claim Number

Any activity that is added or changed by contract modification or used to justify claimed time shall be identified by a mod or claim code that changed the activity. Activities shall not belong to more than one modification or claim item. The modification or claim number of each activity shall be identified by the Mod or Claim Number. Whenever possible, changes shall be added to the schedule by adding new activities. Existing activities shall not normally be changed to reflect modifications.

#### 3.3.2.8 Bid Item

All activities shall be identified in the project schedule by the Bid Item to which the activity belongs. An activity shall not contain work in more

than one bid item. The bid item for each appropriate activity shall be identified by the Bid Item Code.

#### 3.3.2.9 Phase of Work

All activities shall be identified in the project schedule by the phases of work in which the activity occurs. Activities shall not contain work in more than one phase of work. The project phase of each activity shall be by the unique Phase of Work Code.

#### 3.3.2.10 Category of Work

All Activities shall be identified in the project schedule according to the category of work which best describes the activity. Category of work refers, but is not limited, to the procurement chain of activities including such items as submittals, approvals, procurement, fabrication, delivery, installation, start-up, and testing. The category of work for each activity shall be identified by the Category of Work Code.

#### 3.3.2.11 Feature of Work

All activities shall be identified in the project schedule according to the feature of work to which the activity belongs. Feature of work refers, but is not limited to, a work breakdown structure for the project. The feature of work for each activity shall be identified by the Feature of Work Code.

### 3.3.3 Scheduled Project Completion

The schedule interval shall extend from NTP to the contract completion date.

#### 3.3.3.1 Project Start Date

The schedule shall start no earlier than the date on which the NTP was acknowledged. The Contractor shall include as the first activity in the project schedule an activity called "Start Project". The "Start Project" activity shall have an "ES" constraint date equal to the date that the NTP was acknowledged, and a zero day duration.

#### 3.3.3.2 Constraint of Last Activity

Completion of the last activity in the schedule shall be constrained by the contract completion date. Calculation on project updates shall be such that if the early finish of the last activity falls after the contract completion date, then the float calculation shall reflect a negative float on the critical path. The Contractor shall include as the last activity in the project schedule an activity called "End Project". The "End Project" activity shall have an "LF" constraint date equal to the completion date for the project, and a zero day duration.

#### 3.3.3.3 Early Project Completion

In the event the project schedule shows completion of the project prior to the contract completion date, the Contractor shall identify those activities that have been accelerated and/or those activities that are scheduled in parallel to support the Contractor's "early" completion. Contractor shall specifically address each of the activities noted in the narrative report at every project schedule update period to assist the Contracting Officer in evaluating the Contractor's ability to actually complete prior to the contract period.

### 3.3.4 Interim Completion Dates

Contractually specified interim completion dates shall also be constrained to show negative float if the early finish date of the last activity in that phase falls after the interim completion date.

#### 3.3.4.1 Start Phase

The Contractor shall include as the first activity for a project phase an activity called "Start Phase X" where "X" refers to the phase of work. The "Start Phase X" activity shall have an "ES" constraint date equal to the date on which the NTP was acknowledged, and a zero day duration.

#### 3.3.4.2 End Phase

The Contractor shall include as the last activity in a project phase an activity called "End Phase X" where "X" refers to the phase of work. The "End Phase X" activity shall have an "LF" constraint date equal to the completion date for the project, and a zero day duration.

#### 3.3.4.3 Phase X

The Contractor shall include a hammock type activity for each project phase called "Phase X" where "X" refers to the phase of work. The "Phase X" activity shall be logically tied to the earliest and latest activities in the phase.

### 3.3.5 Default Progress Data Disallowed

Actual Start and Finish dates shall not be automatically updated by default mechanisms that may be included in CPM scheduling software systems. Actual Start and Finish dates on the CPM schedule shall match those dates provided from Contractor Quality Control Reports. Failure of the Contractor to document the Actual Start and Finish dates on the Daily Quality Control report for every in-progress or completed activity, and failure to ensure that the data contained on the Daily Quality Control reports is the sole basis for schedule updating shall result in the disapproval of the Contractor's schedule and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes. Updating of the percent complete and the remaining duration of any activity shall be independent functions. Program features which calculate one of these parameters from the other shall be disabled.

### 3.3.6 Out-of-Sequence Progress

Activities that have posted progress without all preceding logic being satisfied (Out-of-Sequence Progress) will be allowed only on a case-by-case approval of the Contracting Officer. The Contractor shall propose logic corrections to eliminate all out of sequence progress or justify not changing the sequencing for approval prior to submitting an updated project schedule.

### 3.3.7 Negative Lags

Lag durations contained in the project schedule shall not have a negative value.

## 3.4 PROJECT SCHEDULE SUBMISSIONS

The Contractor shall provide the submissions as described below. The data disk, reports, and network diagrams required for each submission are contained in paragraph SUBMISSION REQUIREMENTS.

#### 3.4.1 Preliminary Project Schedule Submission

The Preliminary Project Schedule, defining the Contractor's planned operations for the first 60 calendar days shall be submitted for approval within 20 calendar days after the NTP is acknowledged. The approved preliminary schedule shall be used for payment purposes not to exceed 60 calendar days after NTP.

#### 3.4.2 Initial Project Schedule Submission

The Initial Project Schedule shall be submitted for approval within 40 calendar days after NTP. The schedule shall provide a reasonable sequence of activities which represent work through the entire project and shall be at a reasonable level of detail.

#### 3.4.3 Monthly Schedule Updates

Based on the result of progress meetings, specified in "Monthly Progress Meetings," the Contractor shall submit monthly schedule updates. These submissions shall enable the Contracting Officer to assess Contractor's progress. If the Contractor fails or refuses to furnish the information and project schedule data, which in the judgement of the Contracting Officer or authorized representative is necessary for verifying the Contractor's progress, the Contractor shall be deemed not to have provided an estimate upon which progress payment may be made.

#### 3.4.4 Standard Activity Coding Dictionary

The Contractor shall use the activity coding structure defined in the Standard Data Exchange Format (SDEF) in ER 1-1-11, Appendix A. This exact structure is mandatory, even if some fields are not used.

### 3.5 SUBMISSION REQUIREMENTS

The following items shall be submitted by the Contractor for the preliminary submission, initial submission, and every monthly project schedule update throughout the life of the project:

#### 3.5.1 Data Disks

Two data disks containing the project schedule shall be provided. Data on the disks shall adhere to the SDEF format specified in ER 1-1-11, Appendix A.

##### 3.5.1.1 File Medium

Required data shall be submitted on 3.5 disks, formatted to hold 1.44 MB of data, compatible with Microsoft Windows 95/98 operating systems, unless otherwise approved by the Contracting Officer.

##### 3.5.1.2 Disk Label

A permanent exterior label shall be affixed to each disk submitted. The label shall indicate the type of schedule (Preliminary, Initial, Update, or

Change), full contract number, project name, project location, data date, name and telephone number or person responsible for the schedule.

#### 3.5.1.3 File Name

Each file submitted shall have a name related to either the schedule data date, project name, or contract number. The Contractor shall develop a naming convention that will ensure that the names of the files submitted are unique. The Contractor shall submit the file naming convention to the Contracting Officer for approval.

#### 3.5.2 Narrative Report

A Narrative Report shall be provided with the preliminary, initial, and each update of the project schedule. This report shall be provided as the basis of the Contractor's progress payment request. The Narrative Report shall include: a description of activities along the 2 most critical paths, a description of current and anticipated problem areas or delaying factors and their impact, and an explanation of corrective actions taken or required to be taken. The narrative report is expected to relay to the Government, the Contractor's thorough analysis of the schedule output and its plans to compensate for any problems, either current or potential, which are revealed through that analysis.

#### 3.5.3 Approved Changes Verification

Only project schedule changes that have been previously approved by the Contracting Officer shall be included in the schedule submission. The Narrative Report shall specifically reference, on an activity by activity basis, all changes made since the previous period and relate each change to documented, approved schedule changes.

#### 3.5.4 Schedule Reports

The format for each activity for the schedule reports listed below shall contain: Activity Numbers, Activity Description, Original Duration, Remaining Duration, Early Start Date, Early Finish Date, Late Start Date, Late Finish Date, Total Float. Actual Start and Actual Finish Dates shall be printed for those activities in progress or completed.

##### 3.5.4.1 Activity Report

A list of all activities sorted according to activity number.

##### 3.5.4.2 Logic Report

A list of Preceding and Succeeding activities for every activity in ascending order by activity number. Preceding and succeeding activities shall include all information listed above in paragraph Schedule Reports. A blank line shall be left between each activity grouping.

##### 3.5.4.3 Total Float Report

A list of all incomplete activities sorted in ascending order of total float. Activities which have the same amount of total float shall be listed in ascending order of Early Start Dates. Completed activities shall not be shown on this report.

##### 3.5.4.4 Earnings Report

A compilation of the Contractor's Total Earnings on the project from the NTP until the most recent Monthly Progress Meeting. This report shall reflect the Earnings of specific activities based on the agreements made in the field and approved between the Contractor and Contracting Officer at the most recent Monthly Progress Meeting. Provided that the Contractor has provided a complete schedule update, this report shall serve as the basis of determining Contractor Payment. Activities shall be grouped by bid item and sorted by activity numbers. This report shall: sum all activities in a bid item and provide a bid item percent; and complete and sum all bid items to provide a total project percent complete. The printed report shall contain, for each activity: the Activity Number, Activity Description, Original Budgeted Amount, Total Quantity, Quantity to Date, Percent Complete (based on cost), and Earnings to Date.

### 3.5.5 Network Diagram

The network diagram shall be required on the initial schedule submission and on monthly schedule update submissions. The network diagram shall depict and display the order and interdependence of activities and the sequence in which the work is to be accomplished. The Contracting Officer will use, but is not limited to, the following conditions to review compliance with this paragraph:

#### 3.5.5.1 Continuous Flow

Diagrams shall show a continuous flow from left to right with no arrows from right to left. The activity number, description, duration, and estimated earned value shall be shown on the diagram.

#### 3.5.5.2 Project Milestone Dates

Dates shall be shown on the diagram for start of project, any contract required interim completion dates, and contract completion dates.

#### 3.5.5.3 Critical Path

The critical path shall be clearly shown.

#### 3.5.5.4 Banding

Activities shall be grouped to assist in the understanding of the activity sequence. Typically, this flow will group activities by category of work, work area and/or responsibility.

#### 3.5.5.5 S-Curves

Earnings curves showing projected early and late earnings and earnings to date.

### 3.6 PERIODIC PROGRESS MEETINGS

Progress meetings to discuss payment shall include a monthly onsite meeting or other regular intervals mutually agreed to at the preconstruction conference. During this meeting the Contractor shall describe, on an activity by activity basis, all proposed revisions and adjustments to the project schedule required to reflect the current status of the project. The Contracting Officer will approve activity progress, proposed revisions, and adjustments as appropriate.

### 3.6.1 Meeting Attendance

The Contractor's Project Manager and Scheduler shall attend the regular progress meeting.

### 3.6.2 Update Submission Following Progress Meeting

A complete update of the project schedule containing all approved progress, revisions, and adjustments, based on the regular progress meeting, shall be submitted not later than 4 working days after the monthly progress meeting.

### 3.6.3 Progress Meeting Contents

Update information, including Actual Start Dates, Actual Finish Dates, Remaining Durations, and Cost-to-Date shall be subject to the approval of the Contracting Officer. As a minimum, the Contractor shall address the following items on an activity by activity basis during each progress meeting.

#### 3.6.3.1 Start and Finish Dates

The Actual Start and Actual Finish dates for each activity currently in-progress or completed .

#### 3.6.3.2 Time Completion

The estimated Remaining Duration for each activity in-progress. Time-based progress calculations shall be based on Remaining Duration for each activity.

#### 3.6.3.3 Cost Completion

The earnings for each activity started. Payment will be based on earnings for each in-progress or completed activity. Payment for individual activities will not be made for work that contains quality defects. A portion of the overall project amount may be retained based on delays of activities.

#### 3.6.3.4 Logic Changes

All logic changes pertaining to NTP on change orders, change orders to be incorporated into the schedule, contractor proposed changes in work sequence, corrections to schedule logic for out-of-sequence progress, lag durations, and other changes that have been made pursuant to contract provisions shall be specifically identified and discussed.

#### 3.6.3.5 Other Changes

Other changes required due to delays in completion of any activity or group of activities include: 1) delays beyond the Contractor's control, such as strikes and unusual weather. 2) delays encountered due to submittals, Government Activities, deliveries or work stoppages which make re-planning the work necessary. 3) Changes required to correct a schedule which does not represent the actual or planned prosecution and progress of the work.

### 3.7 REQUESTS FOR TIME EXTENSIONS

In the event the Contractor requests an extension of the contract

completion date, or any interim milestone date, the Contractor shall furnish the following for a determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract: justification, project schedule data, and supporting evidence as the Contracting Officer may deem necessary. Submission of proof of delay, based on revised activity logic, duration, and costs (updated to the specific date that the delay occurred) is obligatory to any approvals.

### 3.7.1 Justification of Delay

The project schedule shall clearly display that the Contractor has used, in full, all the float time available for the work involved with this request.

The Contracting Officer's determination as to the number of allowable days of contract extension shall be based upon the project schedule updates in effect for the time period in question, and other factual information. Actual delays that are found to be caused by the Contractor's own actions, which result in the extension of the schedule, will not be a cause for a time extension to the contract completion date.

### 3.7.2 Submission Requirements

The Contractor shall submit a justification for each request for a change in the contract completion date of under 2 weeks based upon the most recent schedule update at the time of the NTP or constructive direction issued for the change. Such a request shall be in accordance with the requirements of other appropriate Contract Clauses and shall include, as a minimum:

- a. A list of affected activities, with their associated project schedule activity number.
- b. A brief explanation of the causes of the change.
- c. An analysis of the overall impact of the changes proposed.
- d. A sub-network of the affected area.

Activities impacted in each justification for change shall be identified by a unique activity code contained in the required data file.

### 3.7.3 Additional Submission Requirements

For any requested time extension of over 2 weeks, the Contracting Officer may request an interim update with revised activities for a specific change request. The Contractor shall provide this disk within 4 days of the Contracting Officer's request.

## 3.8 DIRECTED CHANGES

If the NTP is issued for changes prior to settlement of price and/or time, the Contractor shall submit proposed schedule revisions to the Contracting Officer within 2 weeks of the NTP being issued. The proposed revisions to the schedule will be approved by the Contracting Officer prior to inclusion of those changes within the project schedule. If the Contractor fails to submit the proposed revisions, the Contracting Officer may furnish the Contractor with suggested revisions to the project schedule. The Contractor shall include these revisions in the project schedule until revisions are submitted, and final changes and impacts have been negotiated. If the Contractor has any objections to the revisions furnished by the Contracting Officer, the Contractor shall advise the

Contracting Officer within 2 weeks of receipt of the revisions. Regardless of the objections, the Contractor shall continue to update the schedule with the Contracting Officer's revisions until a mutual agreement in the revisions is reached. If the Contractor fails to submit alternative revisions within 2 weeks of receipt of the Contracting Officer's proposed revisions, the Contractor will be deemed to have concurred with the Contracting Officer's proposed revisions. The proposed revisions will then be the basis for an equitable adjustment for performance of the work.

### 3.9 OWNERSHIP OF FLOAT

Float available in the schedule, at any time, shall not be considered for the exclusive use of either the Government or the Contractor.

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SECTION 01330

SUBMITTAL PROCEDURES

09/01; Omaha Update 11/02

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## SECTION 01330

SUBMITTAL PROCEDURES  
09/01; Omaha Update 11/02

## PART 1 GENERAL

Attachments: Submittal Register  
ENG Form 4025, Transmittal Form

## 1.1 CONTRACTOR RESPONSIBILITIES

The Contractor is responsible for total management of his work including scheduling, control, and certification of all submittals. The submittal management system provided in these specifications is intended to be a complete system for the Contractor to use to control the quality of materials, equipment and workmanship provided by manufacturers, fabricators, suppliers and subcontractors. The Contractor shall review each submittal for contract compliance. Submittals that comply will be forwarded to the Government. Submittals that do not conform will be returned to the originator to be corrected. The Submittal Register (ENG Form 4288) will be utilized to log and monitor all submittal activities. No construction or installation activities shall be performed prior to required approvals of applicable submittals. The Contractor shall perform a check to assure that all materials and/or equipment have been tested, submitted and approved during the preparatory phase of quality control inspections.

## 1.2 SUBMITTAL IDENTIFICATION (SD)

Submittals required are identified by SD numbers and titles as follows:

## SD-01 Preconstruction Submittals

Tabular lists showing location, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work.

In addition, the following items are included:

Construction Progress Schedule  
Health and safety plan  
Work plan  
Quality control plan  
Environmental protection plan  
Permits

## SD-02 Shop Drawings

Submittals which graphically show relationship of various components of the work, schematic diagrams of systems, details of fabrication, layouts of particular elements, connections, and other relational aspects of the work.

## SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

#### SD-04 Samples

Samples, including both fabricated and unfabricated physical examples of materials, products, and units of work as complete units or as portions of units of work.

Physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged. Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site establish standards by which the ensuring work can be judged. Includes assemblies or portions of assemblies which are to be incorporated into the project and those which will be removed at conclusion of the work.

#### SD-05 Design Data

Calculations, mix designs, analyses or other data pertaining to a part of work.

#### SD-06 Test Reports

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accordance with specified requirements. (Testing must have been within three years of date of contract award for the project.)

Report which includes findings of a test required to be performed by the contractor on an actual portion of the work or prototype prepared for the project before shipment to job site.

Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

Investigation reports

Daily checklists

Final acceptance test and operational test procedure

#### SD-07 Certificates

A document, required of the Contractor, or through the Contractor, from a supplier, installer, manufacturer, or other lower tier Contractor, the purpose of which is to confirm the quality or orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel, qualifications, or other verifications of quality.

Statement signed by an official authorized to certify on behalf of the

manufacturer of a product, system or material, attesting that the product, system or material meets specified requirements. The statement must be dated after the award of the contract, must state the Contractor's name and address, must name the project and location, and must list the specific requirements which are being certified.

Confined space entry permits.

#### SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, including special notices and material safety data sheets, if any, concerning impedances, hazards, and safety precautions.

#### SD-09 Manufacturer's Field Reports

Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

Factory test reports.

#### SD-10 Operation and Maintenance Data

Data intended to be incorporated in operations and maintenance manuals.

#### SD-11 Closeout Submittals

Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.

In addition, the following items are included:

As-built drawings

Special warranties

Posted operating instructions

Training plan

### 1.3 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

#### 1.3.1 Government Approved

Governmental approval is required for extensions of design, critical materials, deviations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," they are considered to be "shop drawings." All submittals noted in the technical specifications and Submittal Register as "G-DO", "G-AE" or "G-AO" are subject to Government Approval.

#### 1.3.2 Information Only (FIO)

All submittals not requiring Government approval will be for information only. They are not considered to be "shop drawings" within the terms of

the Contract Clause referred to above. The Contracting Officer has the option to review any submittal.

### 1.3.3 Administrative Submittals

The submittal items listed below are not be included on the Submittal Register (as discussed below). Unless directed otherwise by the Contracting Officer, the following administrative submittals shall be submitted to the Area or Resident (as directed) Office, for approval, via a Serial Letter: Quality Control Plans (Section 01451A CONTRACTOR QUALITY CONTROL), Accident Prevention Plans (Section 01400 SPECIAL SAFETY REQUIREMENTS), Environmental Protection Plans (Section 01355 ENVIRONMENTAL PROTECTION) and other submittals as directed by the Contracting Officer. Format for the Serial Letter shall be as directed by the Area or Resident Office. Submittals provided by Serial Letter shall be submitted in two (2) copies to the Area or Resident (as directed) Office.

### 1.4 APPROVED SUBMITTALS

The Contracting Officer's approval of submittals shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory. Approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Contractor Quality Control (CQC) requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work. After submittals have been approved by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

### 1.5 DISAPPROVED SUBMITTALS

The Contractor shall make all corrections required by the Contracting Officer and promptly furnish a corrected submittal in the form and number of copies specified for the initial submittal. If the Contractor considers any correction indicated on the submittals to constitute a change to the contract, a notice in accordance with the Contract Clause "Changes" shall be given promptly to the Contracting Officer.

### 1.6 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

### 1.7 GENERAL

The Contractor shall make submittals as required by the specifications. The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Units of weights and measures used on all submittals shall be the same as those used in the contract drawings. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements. Prior to submittal, all items shall be checked and approved by the Contractor's Quality Control (CQC) System Manager and each item shall be stamped, signed, and dated by the CQC System Manager indicating action taken. Proposed deviations from the contract requirements shall be clearly identified. Submittals shall include items such as: Contractor's,

manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals. Submittals requiring Government approval shall be scheduled and made prior to the acquisition of the material or equipment covered thereby. Samples remaining upon completion of the work shall be picked up and disposed of in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

#### 1.8 SUBMITTAL REGISTER AND ENG FORM 4288 (RMS) SUBMITTAL REGISTER

At the end of this section is a submittal register (submittal form) showing items of equipment and materials for which submittals are required by the specifications; this list may not be all inclusive and additional submittals may be required. The attached submittal register identifies only the submittal section, type of submittal, description of item submitted, paragraph number related to submittal item (section submittal paragraph if none listed), submittal classification (G), and submittal reviewer identifier (ED, AE or RE). Any submittal without a submittal classification and submittal reviewer identifier is considered to be For Information Only (FIO). The submittal register generated by the Government Resident Management System (RMS) Software is used for tracking construction submittals and is referred to as ENG Form 4288 (RMS). The Contractor shall maintain an ENG Form 4288 (RMS) for the project in accordance with the attached ENG Form 4288 (RMS) Instructions. The Contractor will be furnished one (1) set of ENG Forms 4288 (RMS) at the preconstruction conference. Much of the same information contained on the attached submittal register will be included on the ENG Forms 4288 (RMS) furnished to the Contractor. The Contractor shall complete the appropriate columns as indicated on the attached ENG Form 4288 (RMS) Instructions and return to the Contracting Officer for approval within 20 calendar days after the preconstruction conference. The ENG Form 4288 (RMS) will become a part of the contract after approval. A revised ENG Form 4288 (RMS) with ACTIVITY NO. filled in shall be submitted with the completed network analysis system when a network analysis system is a contract requirement. The TRANSMITTAL NUMBER AND ITEM NUMBER shall be left blank for use later to record the respective transmittal and item number corresponding to those listed on the transmittal form entitled: "TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE" (ENG Form 4025). The approved ENG Form 4288 (RMS) will become the scheduling document and will be used to control submittals throughout the life of the contract. The ENG Form 4288 (RMS) and the progress schedules shall be coordinated.

#### 1.9 SCHEDULING

Submittals covering component items forming a system or items that are interrelated shall be scheduled to be coordinated and submitted concurrently. Certifications to be submitted with the pertinent drawings shall be so scheduled. Adequate time (a minimum of 20 calendar days exclusive of mailing time) shall be allowed and shown on the register for review and approval. No delay damages or time extensions will be allowed for time lost in late submittals. [An additional [20] calendar days shall be allowed and shown on the register for review and approval of submittals for [food service equipment] [and] [refrigeration and HVAC control systems.]]

#### 1.10 TRANSMITTAL FORM (ENG FORM 4025)

The sample transmittal form (ENG Form 4025) attached to this section shall be used for submitting both Government approved and information only submittals in accordance with the instructions on the reverse side of the form. These forms will be furnished to the Contractor. This form shall be properly completed by filling out all the heading blank spaces and identifying each item submitted. Special care shall be exercised to ensure proper listing of the specification paragraph and/or sheet number of the contract drawings pertinent to the data submitted for each item.

#### 1.11 SUBMITTAL PROCEDURES

Submittals shall be made as follows:

##### 1.11.1 Procedures

###### 1.11.1.1 "G-DO or G-AE" Submittals

All items listed as "G-DO" or "G-AE" submittals in the various sections or on the Submittal Register shall be mailed directly to the addressee shown below as directed. For each submittal, a completed information copy of the attached transmittal form shall also be mailed to the Area Engineer .

An additional copy of "G-DO", "G-AE" or "G-AO" submittals related to fire protection/detection systems shall be submitted to the Base Civil Engineering Office. The mailing address for these submittals shall be obtained at the preconstruction conference.

##### Technical Reviewer

Engineering Division (ED)  
Attn: CENWO-ED-DI  
U.S. Army Engineer District, Omaha  
106 South 15th Street  
Omaha, NE 68102-1618

Each required submittal which is in the form of a drawing shall be submitted as seven (7) prints of the drawing. Drawing prints shall be either blue or black line permanent-type prints on a white background or blueprint and shall be sufficiently clear and suitable for making legible copies.

All catalog and descriptive data shall be submitted in seven (7) copies. Catalog cuts and other descriptive data which have more than one model, size, or type or which shows optional equipment shall be clearly marked to show the model, size, or type and all optional equipment which is proposed for approval. Submittals on component items forming a system or that are interrelated shall be submitted at one time as a single submittal in order to demonstrate that the items have been properly coordinated and will function as a unit.

###### 1.11.1.2 "G-AO" and FIO Submittals

Except as noted below, data for all items listed as "G-AO" Submittals in the various sections shall be submitted in five (5) copies to the Area Engineer using the transmittal form. Items not to be submitted in multiples, such as samples and test cylinders, shall be submitted to the Area or Resident Engineer (as directed) accompanied by five (5) copies of the transmittal form.

Except as noted below, data for all items listed as FIO Submittals in the various sections shall be submitted in three (3) copies to the Area Engineer using the transmittal form. Items not to be submitted in multiples, such as samples and test cylinders, shall be submitted to the Area or Resident Engineer (as directed) accompanied by three (3) copies of the transmittal form. The Government has the option to review any FIO submittal.

#### 1.11.1.3 Certificates of Compliance

Each certificate shall be signed by an official authorized to certify in behalf of the manufacturing company and shall contain the name and address of the Contractor, the project name and location, and the quantity and date or dates of shipment or delivery to which the certificates apply. Copies of laboratory test reports submitted with certificates shall contain the name and address of the testing laboratory and the date or dates of the tests to which the report applies. Certification shall not be construed as relieving the Contractor from furnishing satisfactory material, if, after tests are performed on selected samples, the material is found not to meet the specific requirements.

#### 1.11.1.4 Purchase Orders

Copies of purchase orders shall be furnished to the Contracting Officer when the Contractor requests assistance for expediting deliveries of equipment or materials, or when requested by the Contracting Officer for the purpose of quality assurance review. Each purchase order issued by the Contractor or his subcontractors for materials and equipment to be incorporated into the project shall (1) be clearly identified with the applicable DA contract number, (2) carry an identifying number, (3) be in sufficient detail to identify the material being purchased, (4) indicate a definite delivery date, and (5) display the DMS priority rating, if applicable.

#### 1.11.1.5 Operation and Maintenance Instructions and/or Manuals

Where required by various technical sections, operations and maintenance instructions and/or manuals with parts lists included shall be provided by the Contractor in quintuplicate, unless otherwise specified, and shall be assembled in three-ring binders with index and tabbed section divider and having a cover indicating the contents by equipment or system name and project title and shall be submitted for approval to the Contracting Officer 90 days prior to final tests of mechanical and electrical systems, unless otherwise specified. Each operation and maintenance manual shall contain a copy of all warranties and a list of local service representatives required by Section 01200 Warranty of Construction. If field testing requires these copies to be revised, they shall be updated and resubmitted for approval within 10 calendar days after completion of tests. The Operations and Maintenance Instructions and/or Manuals shall be shown as a separate activity on the Contractor prepared construction schedule bar chart or network analysis system. In addition, one reproducible unfolded copy of all wiring and control diagrams and approved system layout drawings shall be submitted with the O&M Manuals.

#### 1.11.1.6 Interior/Exterior Finish Sample and Data

All submittals regarding color boards (Section 09915 COLOR SCHEDULE) for interior finish samples and data shall be submitted concurrently and all submittals for exterior finish samples and data shall be submitted

concurrently. These color boards are in addition to the samples required under the specific technical specifications listed as "samples".

#### 1.11.2 Deviations

For submittals which include proposed deviations requested by the Contractor, the column "variation" of ENG Form 4025 shall be checked. The Contractor shall set forth in writing the reason for any deviations and annotate such deviations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

#### 1.12 CONTROL OF SUBMITTALS

The Contractor shall carefully control his procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register."

#### 1.13 GOVERNMENT APPROVED SUBMITTALS

Upon completion of review of submittals requiring Government approval, the submittals will be identified as having received approval by being so stamped and dated.

##### 1.13.1 "G-AE" or "G-DO" Submittals

The drawing print and five (5) sets of all catalog data and descriptive literature and drawing prints will be retained by the Contracting Officer and two (2) sets of catalog data and descriptive literature and drawing prints will be returned to the Contractor.

##### 1.13.2 "G-AO" Submittals

Two (2) copies of "G-RE" submittals for approval will be returned to the Contractor except for samples, test cylinders, and O&M manuals for which two (2) copies of the transmittal form only will be returned to the Contractor.

#### 1.14 INFORMATION ONLY SUBMITTALS

Normally submittals for information only will not be returned. Review by the Contracting Officer is not required on information only submittals. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

#### 1.15 STAMPS

Stamps used by the Contractor on the submittal data to certify that the submittal meets contract requirements shall be similar to the following. The stamp shall be affixed and filled out on the back of each ENG Form 4025.



<p>CONTRACTOR</p> <p>(Firm Name)</p> <p>_____ Approved</p> <p>_____ Approved with corrections as noted on submittal data and/or attached sheets(s).</p> <p>SIGNATURE: _____</p> <p>TITLE: _____</p> <p>DATE: _____</p>
---

INSTRUCTIONS  
ENG FORM 4288 (RMS)

1. The Contractor shall utilize the ENG Form 4288 (RMS) generated by the Government Residential Management System (RMS) software for tracking construction submittals. The Submittal Register information, columns (c) thru (f) from the Submittal Forms furnished with this solicitation, [will be utilized by the Government] to generate the ENG Form 4288 (RMS). [The Government will furnish the Contractor a hard copy of the ENG Form 4288 (RMS) at the preconstruction conference.]. The ENG Form 4288 (RMS) includes the following items and parties responsible for completing the information required on the ENG Form 4288 (RMS). The subparagraph headings below do not correspond to the Submittal Register column headings.

a. Activity Number: will be provided by the Contractor from his Network Analysis, if required, and when a network analysis is accepted.

b. Transmittal Number and Item Number: will be provided by the Contractor from ENG Form 4025 for each item.

c. Specification Paragraph Number: will be provided by the Government from the Submittal Register from column entitled "Specification Paragraph Number".

d. Description of Submittal: will be provided by the Government from the Submittal Register from column entitled "Description of Item Submitted".

e. Type of Submittal: will be provided by the Government from the Submittal Register from column entitled "Type of Submittal" or "Description of Item Submitted".

f. Classification: will be provided by the Government from the Submittal Register from column entitled "Classification".

g. Reviewing Office - Reviewer: will be provided by the Government from the Submittal Register from column entitled "Classification" or "Reviewer".

h. Contractor Schedule Dates: the Contractor will provide schedule dates for

"Submit Needed By" (Date the Contractor expects to submit an item. It is the Contractors responsibility to calculate the lead time needed for the government approval. Note if resubmittal is required it is the Contractors responsibility to make all adjustments necessary to meet the contract completion date.)

"Approval Needed By" (date the Contractor can receive approval and still obtain the material by need date.), and

"Material Needed By" (date that the material is needed at the site. If there is a network analysis it should reflect that date on the analysis.)

i. Contractor Action: Includes the following items: "Code" and "Submit to the Corps". These items will be completed by the Contractor. The action codes will be one of the following:

A - Approved as submitted.

- B - Approved, except as noted.
- G - Other (specify)

j. Government Action: This item includes a Government Action "Code" and "Date" and is reserved for Government use. The Government reserves the right to review any submittal for contract compliance. Receipt of an Action Code "F - Receipt Acknowledged" or failure of the Contractor to receive an Action Code by the Government, does not mean that the submittal is in compliance with the contract requirements. When used by the Government, the action code will be one of the following:

- A - Approved as submitted.
- B - Approved except as noted on drawings.
- C - Approved, except as noted on drawings. Refer to attached \_\_\_\_ sheet resubmission required.
- D - Will be returned by separate correspondence.
- E - Disapproved (See Attached).
- F - Receipt Acknowledged.
- Fx - Receipt acknowledged, does not comply as noted with contract requirements.
- G - Other (specify).

2. Reviewer Abbreviation code will be as follows;

- G-DO, G-AE or G-AO - Government Approved
- For Information Only - Any submittal without a Government Approved abbreviation code.

INSTRUCTIONS  
ENG FORM 4025

1. DATE at the top of form will be the date submitted to the Government which is to be completed by the Contractor.
2. TRANSMITTAL NO. Each new transmittal (i.e. [G-AE,] [G-DO,] G-AO or FIO) shall be numbered consecutively for each specification section in the space provided in "Transmittal No.". This number will be the identifying symbol for each submittal. Example: "15400A-001", "15895A-001" "15895A-002", "16415A-001", etc. For each new submittal or for a resubmittal, the appropriate box must be marked. Resubmittals must be designated by their original sequential number followed by an ".1", ".2", etc. for each sequential resubmittal. Example: "15895A-001.1" (previous submittal No. 15895A-001).
3. TO: Box will contain the name and address of the office which will review the submittal (as designated by the Contracting Officer).
4. FROM: Box will be the name and address of the Contractor. Contractor is to complete this box.
5. CONTRACT NO. box will contain the Contractors construction contract number (e.g., DACXXX-XX-C-XXXX).
6. CHECK ONE box
  - a. CHECK ONE box (for transmittal/ retransmittal) will be completed by the Contractor with one box marked. If a resubmittal is provided last transmittal number will be added.
  - b. CHECK ONE box will be completed by the Contractor with one box marked for the submittal type.
7. SPECIFICATION SECTION NO. box will be completed by the Contractor. The number will be the five digit number found in the specifications. No more than one section will be covered with each transmittal.
8. PROJECT TITLE AND LOCATION box will be completed by the Contractor.
9. Column a, will be completed by the Contractor and will contain a different number for each item submitted in that transmittal. Once a number is assigned to an item it will remain the same even if there is a resubmittal.
10. Column b, will be completed by the Contractor. The description of each item on this form will be the descriptions provided on the submittal register. The Contractor shall submit each submittal register item all at once on one transmittal if possible. If a submittal register item can not be submitted all at once Contractor should note that in the remarks box.
11. Column c, will be completed by the Contractor. The information will be the appropriate submittal description number as described this Section or shown on the submittal register (e.g. SD-XX).
12. Column d, will be completed by the Contractor. The number of copies will be determined by the Contractor after review of submittal register for the classification of the item and after review of paragraph: SUBMITTAL

PROCEDURES of this Section.

13. Column e, will be completed by the Contractor. The Contractor shall state all applicable paragraph numbers.

14. Column f, will be completed by the Contractor. The Contractor shall state all applicable drawing sheet numbers.

15. Column g, will be completed by the Contractor. The action codes will be one of the following:

- A - Approved as submitted.
- B - Approved, except as noted.
- G - Other (specify)

16. Column h, will be completely by the Contractor. A check shall be placed in this column when a submittal is not in accordance with the plans and specifications also, a written statement to that effect shall be included in the space provided for "Remarks".

17. Column i, is reserved for Government use and may or may not be provided. When used by the Government, the action code will be one of the following:

- A - Approved as submitted.
- B - Approved except as noted on drawings.
- C - Approved, except as noted on drawings. Refer to attached \_\_\_\_ sheet resubmission required.
- D - Will be returned by separate correspondence.
- E - Disapproved (See Attached).
- F - Receipt Acknowledged.
- Fx - Receipt acknowledged, does not comply as noted with contract requirements.
- G - Other (specify).

18. REMARKS box self explained.

19. Contractor Quality Control Manager must provide name and sign all Eng Form 4025 certifying conformance. In the space for the name and signature, also include a phone number where the CQC Manager may be reached.

20. Section II will be completed by the Government. Contractor is not to write in this space.

See reverse side of ENG Form 4025 for additional instructions.

-- End of Section --

# SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION

Fish Hatchery - Rearing Ponds and Hatchery Complex

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				REMARKS		
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE		DATE OF ACTION	MAILED TO CONTR/
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		00800	SD-02 Shop Drawings														
			Equipment Room Drawings		G AO												
			Plant Layout Drawings		G AO												
		01200	SD-01 Preconstruction Submittals														
			Proposed Methods of Operation		G AO												
			Progress Charts		G AO												
			Construction Right-of-Way														
			State and Federal Highways	1.8.3													
			State and Local Public Roads	1.8.4													
			SD-02 Shop Drawings														
			Care of Water	1.4	G AO												
			Traffic Control	1.8.1	G AO												
			SD-11 Closeout Submittals														
			Warranty of Construction														
			Equipment Warranty Booklet	1.16.5													
		01355A	SD-01 Preconstruction Submittals														
			Environmental Protection Plan	1.7	G AO												
		01356	SD-07 Certificates														
			Mill Certificate or Affidavit	2.1.3													
		01400	SD-01 Preconstruction Submittals														
			Accident Prevention Plan		G AO												
			SD-07 Certificates														
			Qualifications		G AO												
		02300A	SD-03 Product Data														
			Earthwork														
			SD-06 Test Reports														

**SUBMITTAL REGISTER**

CONTRACT NO.

TITLE AND LOCATION

Fish Hatchery - Rearing Ponds and Hatchery Complex

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						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE		DATE OF ACTION	MAILED TO CONTR/
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02300A	Testing	3.11	G AO												
			SD-07 Certificates														
			Testing	3.11	G AO												
		02315a	SD-06 Test Reports														
			Testing	3.14	G AO												
		02316a	SD-06 Test Reports														
			Field Density Tests	3.5.3	G AO												
			Testing of Backfill Materials	3.5.2	G AO												
		02370A	SD-02 Shop Drawings														
			Layout and Detail Drawings		G DO												
			As-Built Drawings	3.10	G AO												
			SD-03 Product Data														
			Tests, Inspections, and Verifications	2.2	G AO												
			Field Seaming	3.3	G AO												
			Qualifications	1.3	G AO												
			SD-04 Samples														
			Samples	3.4													
			SD-06 Test Reports														
			Material		G AO												
			Surface Preparation	3.1.1	G AO												
			Non-Destructive Field Seam	3.5.1	G AO												
			Continuity Testing														
			Destructive Field Seam Testing	3.5.2	G AO												
			Destructive Seam Test Repairs	3.6.1	G AO												
			Tests	3.5	G AO												

# SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION Fish Hatchery - Rearing Ponds and Hatchery Complex						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY					REMARKS	
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		MAILED TO CONTR/
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02371	SD-03 Product Data														
			Manufacturing Quality Control		G AO												
			Manual Sampling and Testing														
			SD-04 Samples														
			Quality Assurance Samples and Tests	3.1	G AO												
			SD-07 Certificates														
			Geotextile	2.1.1	G AO												
		02373	SD-03 Product Data														
			Manufacturing Quality Control		G AO												
			Manual Sampling and Testing														
			SD-07 Certificates														
			Geotextile	2.1.1	G AO												
		02510a	SD-03 Product Data														
			Installation	3.1													
			Waste Water Disposal Method														
			Satisfactory Installation														
			SD-06 Test Reports														
			Bacteriological Disinfection	3.3													
			Bacteriological Disinfection	3.3.1													
			SD-07 Certificates														
			Manufacturer's Representative	1.3													
			Installation	3.1													
		02531a	SD-07 Certificates														
			Portland Cement	2.7.1													
			Joints	2.3													

**SUBMITTAL REGISTER**

CONTRACT NO.

TITLE AND LOCATION Fish Hatchery - Rearing Ponds and Hatchery Complex						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY					REMARKS	
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		MAILED TO CONTR/ DATE RCD FRM APPR AUTH
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02532a	SD-06 Test Reports														
			Hydrostatic Tests	3.2	G AO												
		02560	SD-03 Product Data														
			Plant, Equipment, and Tools	1.9													
			Job Mix Formula	2.1.1	G DO												
			Mixture Proportions	2.3.1	G DO												
			SD-06 Test Reports														
			Initial Tests	2.9	G AO												
			Contractor Quality Control	3.2.1	G AO												
			Contractor Quality Control	3.4.4	G AO												
			Acceptability of Work	3.2.2	G AO												
			Acceptability of Work	3.4.5	G AO												
			Acceptability of Work	3.5.2	G AO												
			SD-07 Certificates														
			Asphalt Cement Binder	2.1.3	G AO												
			Bituminous Tack and Prime Coat	2.2	G AO												
			SD-08 Manufacturer's Instructions														
			Manufacturer's Recommendations	3.4.3	G AO												
		02630A	SD-03 Product Data														
			Placing Pipe	3.3													
			SD-07 Certificates														
			Resin Certification	2.1.3													
			Resin Certification	2.1.4													
			Determination of Density	3.6.4													
			Frame and Cover for Gratings	2.3.3													
		02763A	SD-03 Product Data														

# SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION

Fish Hatchery - Rearing Ponds and Hatchery Complex

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				REMARKS		
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE		DATE OF ACTION	MAILED TO CONTR/
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02763A	Equipment Composition Requirements Qualifications SD-07 Certificates Volatile Organic Compound (VOC)	1.4	G AO												
		02770A	SD-03 Product Data Concrete SD-06 Test Reports Field Quality Control	2.1 3.8													
		02811a	SD-02 Shop Drawings Sprinkler System SD-03 Product Data Spare Parts Design Analysis and Calculations SD-06 Test Reports Field Tests SD-10 Operation and Maintenance Data Sprinkler System	3.1 3.1	G DO G DO												
		02821A	SD-07 Certificates Chain Link Fence Ornamental Steel Fence	2.1.1 2.7													
		02921a	SD-03 Product Data Equipment Surface Erosion Control Material	2.7													

# SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION						CONTRACTOR											
Fish Hatchery - Rearing Ponds and Hatchery Complex																	
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS	
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		02921a	Chemical Treatment Material														
			Delivery	1.4.1													
			Finished Grade and Topsoil	3.2.1													
			Topsoil	2.2													
			Quantity Check	3.5													
			Seed Establishment Period	3.9													
			Maintenance Record	3.9.3.5													
			Application of Pesticide	3.6													
			SD-04 Samples														
			Delivered Topsoil	1.4.1.1													
			Soil Amendments	2.3													
			Mulch	2.4													
			SD-06 Test Reports														
			Equipment Calibration	3.1.3													
			SD-07 Certificates														
			Seed	2.1													
			Topsoil	2.2													
			Fertilizer	2.3.1													
			Organic Material	2.3.2													
			Mulch	2.4													
			Pesticide	2.6													
		02930a	SD-03 Product Data														
			Chemical Treatment Material	1.4.3.2													
			Equipment	3.7.2													
			Delivery	1.4.1													
			Plant Establishment Period	3.9	G AO												

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		02930a	Maintenance Record	3.9.2.6													
			Application of Pesticide	3.7													
			SD-04 Samples														
			Delivered Topsoil	1.4.1.3													
			Soil Amendments														
			Mulch	2.4	G AO												
			Decorative Boulders	2.14													
			SD-06 Test Reports														
			Percolation Test	3.1.4.1													
			SD-07 Certificates														
			Plant Material	2.1													
			Topsoil	2.2													
			Fertilizer	2.3.1													
			Organic Material	2.3.2													
			Organic Mulch														
			Mycorrhizal Fungi Inoculum	2.10													
			Pesticide	2.12													
			SD-10 Operation and Maintenance Data														
			Maintenance Instructions	3.9.5													
		03150a	SD-02 Shop Drawings														
			Waterstops	2.4	G DO												
			SD-03 Product Data														
			Waterstops	2.4													
			SD-07 Certificates														
			Sealant	2.3													

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		03150a	Waterstops	2.4													
		03200a	SD-02 Shop Drawings Reinforcement	3.1	G DO												
			SD-07 Certificates Reinforcing Steel	2.2													
		03300	SD-03 Product Data Mixture Proportions	1.5	G DO												
			SD-06 Test Reports Testing and Inspection for Contractor Quality Control	3.12													
			SD-07 Certificates Qualifications	1.3													
		04200a	SD-02 Shop Drawings Masonry Work		G DO												
			SD-03 Product Data Cultured Stone	2.2	G DO												
			Insulation		G DO												
			Cold Weather Installation	3.1.2	G AO												
			SD-06 Test Reports Efflorescence Test	3.17.3	G AO												
			Field Testing of Mortar	3.17.1	G AO												
			Field Testing of Grout	3.17.2	G AO												
			Prism tests		G AO												
			Masonry Cement		G AO												
			Fire-rated CMU	2.4.3	G AO												
			SD-07 Certificates														

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		04200a	Control Joint Keys	2.12													
			Anchors, Ties, and Bar Positioners	2.9													
			Expansion-Joint Materials	2.13													
			Joint Reinforcement	2.10													
			Reinforcing Steel Bars and Rods	2.11													
			Masonry Cement														
			Precast Concrete Items	2.6													
			Mortar Admixtures														
			Grout Admixtures														
			Cultured Stone Installation														
			Samples		G DO												
		05093a	SD-02 Shop Drawings														
			Pressure Piping		G DO												
			SD-03 Product Data														
			Qualifications	1.6	G AO												
			Welding Operations	3.1	G AO												
			SD-07 Certificates														
			Qualifications	1.6	G AO												
		05120a	SD-02 Shop Drawings														
			Structural Steel System		G DO												
			Structural Connections	3.2.1	G DO												
			SD-03 Product Data														
			Erection	3.2													
			Welding	3.3	G AO												
			SD-06 Test Reports														

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		05120a	Quality Control		G AO												
			SD-07 Certificates														
			Mill Test Reports														
			Welder Qualifications		G AO												
			Welding Inspector	1.5	G AO												
		05300a	SD-02 Shop Drawings														
			Deck Units	2.1	G DO												
			Accessories	2.5	G DO												
			Attachments	3.2	G DO												
			Holes and Openings	3.3	G DO												
			SD-03 Product Data														
			Deck Units	2.1	G AO												
			Attachments	3.2	G AO												
		05400A	SD-02 Shop Drawings														
			Framing Components		G DO												
			SD-05 Design Data														
			Steel Studs, Tracks, Bracing, Bridging, AND Accessories	2.1	G DO												
			SD-07 Certificates														
			Mill Certificates														
			Welds	3.2.1													
		05500a	SD-02 Shop Drawings														
			Miscellaneous Metal Items	1.6	G DO												
			Canal Gates		G DO												
			Expansion Anchor														
			SD-04 Samples														

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		05500a	Miscellaneous Metal Items	1.6	G DO												
		06100A	SD-07 Certificates														
			Grading and Marking	2.1.1													
			Insulation	2.3													
		06200A	SD-02 Shop Drawings														
			Finish Carpentry		G DO												
			SD-04 Samples														
			Bulletin Board Finishes		G DO												
			Moldings & Trim		G DO												
		06410A	SD-02 Shop Drawings														
			Shop Drawings	1.8	G DO												
			Installation	3.1	G AO												
			SD-03 Product Data														
			Wood Materials	2.1	G DO												
			Wood Finishes	2.9	G DO												
			Finish Schedule	2.11.7.3	G DO												
			SD-04 Samples														
			Plastic Laminates	2.3	G DO												
			Cabinet Hardware	2.6	G DO												
			Red Oak Plywood Veener		G DO												
			SD-07 Certificates														
			Quality Assurance	1.4													
		06650	SD-02 Shop Drawings														
			Shop Drawings		G DO												
			Installation	3.2	G AO												
			SD-03 Product Data														

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		06650	Solid polymer material	2.1	G DO													
			Epoxy Resin material															
			Qualifications	1.6	G AO													
			Fabrications	2.4	G AO													
			SD-04 Samples															
			Material	2.1	G DO													
			Counter and Vanity Tops		G DO													
			SD-06 Test Reports															
			Solid polymer material	2.1														
			Epoxy Resin material															
			SD-07 Certificates															
			Fabrications	2.4														
			Qualifications	1.6														
			SD-10 Operation and Maintenance															
			Data															
			Solid polymer and epoxy resin material															
			Clean-up															
		07240	SD-02 Shop Drawings															
			Shop drawings	3.3	G DO													
			SD-03 Product Data															
			Thermal insulation	2.4	G DO													
			Adhesive	2.2	G DO													
			Mechanical Fasteners	2.3	G DO													
			Accessories	2.10	G DO													
			Base coat	2.5	G DO													

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		07240	Portland cement	2.6	G DO												
			Reinforcing fabric	2.7	G DO												
			Finish coat	2.8	G DO												
			Joint Sealant	2.11	G DO												
			Primer	2.9	G DO												
			Bond breaker	2.12	G DO												
			Backer Rod	2.13	G DO												
			Insulation Board	1.4.4	G DO												
			Warranty	1.7	G DO												
			SD-04 Samples														
			Sample Boards	1.2.3.7													
			SD-05 Design Data														
			Wind load	1.2.1.2													
			Moisture analysis	1.2.4													
			SD-06 Test Reports														
			Abrasion resistance	1.2.3.1													
			Accelerated weathering	1.2.3.2													
			Impact resistance	1.2.2.3													
			Mildew resistance	1.2.3.3													
			Salt spray resistance	1.2.3.4													
			Water vapor transmission														
			Absorption-freeze-thaw	1.2.3.6													
			Flame spread														
			Water penetration	1.2.1.1													
			Water penetration	1.2.3.8													
			Water resistance	1.2.3.5													

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		07240	Surface Burning Characteristics	1.2.2.1													
			Radiant heat	1.2.2.2													
			Substrate	3.1													
			Wind load	1.2.1.2													
			SD-07 Certificates														
			Qualifications of EIFS Manufacturer	1.4.1													
			Qualification of EIFS Installer	1.4.2													
			Qualification of Sealant Applicator	1.4.3													
			Qualifications of Third Party Inspector (Manufacturer's Field Representative)														
			Inspection Check List	3.5.2													
			SD-08 Manufacturer's Instructions														
			Installation	3.3													
			SD-10 Operation and Maintenance														
			Data														
			EIFS	1.7													
		07416A	SD-02 Shop Drawings														
			Structural Standing Seam Metal Roof System		G DO												
			SD-03 Product Data														
			Design Analysis		G DO												
			Qualifications														
			SD-04 Samples														
			Accessories	2.3	G DO												

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																		(g)
		07416A	Roof Panels	2.1	G DO													
			Factory Color Finish	2.6	G DO													
			Fasteners	2.4	G DO													
			Insulation	2.7	G DO													
			Gaskets and Insulating Compounds	2.10	G DO													
			Sealant	2.9	G DO													
			Concealed Anchor Clips	2.2	G DO													
			Subpurlins	2.5	G DO													
			EPDM Rubber Boots	2.12	G DO													
			Snow Guards		G DO.													
			SD-06 Test Reports															
			Test Report for Uplift Resistance of the SSSMR		G DO													
			SD-07 Certificates															
			Structural Standing Seam Metal Roof System															
			Insulation	2.7	G DO													
		07600A	SD-02 Shop Drawings															
			Materials	2.1	G DO													
		07810	SD-03 Product Data															
			Fireproofing Material	3.3	G DO													
			SD-06 Test Reports															
			Fire Resistance Rating	1.6	G AO													
			SD-07 Certificates															
			Installer Qualifications	1.5														

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		07840A	SD-02 Shop Drawings																
			Firestopping Materials	2.1	G AO														
			SD-07 Certificates																
			Firestopping Materials	2.1															
			Installer Qualifications	1.5	G AO														
			Inspection	3.3															
		07900A	SD-03 Product Data																
			Backing	2.1	G AO														
			Bond-Breaker	2.2	G AO														
			Sealant	2.5	G AO														
			SD-07 Certificates																
			Sealant	2.5															
		08110	SD-02 Shop Drawings																
			Doors	2.1	G G														
			Doors	2.1	G G														
			Frames	2.5	G G														
			Frames	2.5	G G														
			Accessories	2.3															
			Weatherstripping	2.7	G DO														
			SD-03 Product Data																
			Doors	2.1	G DO														
			Frames	2.5	G DO														
			Accessories	2.3	G DO														
		08120	SD-02 Shop Drawings																
			Doors and frames	2.1	G DO														
			SD-04 Samples																

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		08120	Doors and frames	2.1	G DO												
			SD-08 Manufacturer's Instructions														
			Doors and frames	2.1	G AO												
		08210	SD-02 Shop Drawings														
			Doors	2.1	G DO												
			SD-03 Product Data														
			Doors	2.1	G DO												
			Accessories	2.2	G DO												
			warranty	1.4	G DO												
			Fire resistance rating	2.1.3	G DO												
			SD-04 Samples														
			Doors	2.1	G DO												
			Door finish colors	2.3.5.3	G DO												
			SD-06 Test Reports														
			Split resistance	2.4													
			Cycle-slam	2.4													
			Hinge loading resistance	2.4													
		08330A	SD-02 Shop Drawings														
			Approved Detail Drawings	3.1	G DO												
			Installation	3.1	G AO												
			SD-03 Product Data														
			Overhead Rolling Doors	2.1	G DO												
			SD-04 Samples														
			Overhead Rolling Doors	2.1	G DO												
			SD-10 Operation and Maintenance Data														

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		08330A	Operation and Maintenance Manuals	1.6	G AO												
		08331A	SD-02 Shop Drawings														
			Approved Detail Drawings	3.1	G DO												
			SD-03 Product Data														
			Rolling Counter Doors		G DO												
			Installation	3.1	G AO												
			Cleaning	3.3	G AO												
			SD-10 Operation and Maintenance Data														
			Operation	2.4													
		08361	SD-02 Shop Drawings														
			Doors	2.2	G DO												
			SD-03 Product Data														
			Doors	2.2	G DO												
			Electric operators	2.5	G DO												
			SD-08 Manufacturer's Instructions														
			Doors	2.2													
			SD-10 Operation and Maintenance Data														
			Doors	2.2	G AO												
		08520A	SD-02 Shop Drawings														
			Aluminum Windows		G DO												
			Insect Screens	2.3	G DO												
			SD-03 Product Data														
			Aluminum Windows		G DO												

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		08520A	SD-04 Samples														
			Aluminum Windows		G DO												
			SD-06 Test Reports														
			Aluminum Windows														
			SD-07 Certificates														
			Aluminum Windows														
		08710	SD-02 Shop Drawings														
			Hardware schedule	1.3	G DO												
			Keying system	2.3.7	G DO												
			SD-03 Product Data														
			Hardware items	2.3	G DO												
			SD-08 Manufacturer's Instructions														
			Installation	3.1													
			SD-10 Operation and Maintenance														
			Data														
			Hardware Schedule	1.3	G DO												
			SD-11 Closeout Submittals														
			Key bitting	1.4													
					11												
		08810A	SD-02 Shop Drawings														
			Installation	3.2	G DO												
			SD-03 Product Data														
			Insulating Glass	2.3	G DO												
			Glazing Accessories	2.6	G DO												
			SD-04 Samples														
			Insulating Glass	2.3	G DO												

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		08810A	SD-07 Certificates														
			Insulating Glass	2.3													
		09250	SD-03 Product Data														
			Cementitious backer units	2.1.4	G AO												
			Water-Resistant Gypsum Backing Board	2.1.3	G AO												
			Accessories	2.1.10	G AO												
			SD-07 Certificates														
			Asbestos Free Materials	2.1													
		09310	SD-02 Shop Drawings														
			Installation		G DO												
			SD-03 Product Data														
			Tile	2.1	G DO												
			Setting-Bed	2.2	G DO												
			Mortar, Grout, and Adhesive		G DO												
			SD-04 Samples														
			Tile	2.1	G DO												
			Grout		G DO												
			Accessories	2.1.4	G DO												
			Marble Thresholds	2.5	G DO												
			SD-07 Certificates														
			Tile	2.1													
			Mortar, Grout, and Adhesive														
		09510	SD-02 Shop Drawings														
			Approved Detail Drawings	1.3	G DO												
			SD-03 Product Data														

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		09510	Acoustical Ceiling Systems		G DO												
			SD-04 Samples														
			Acoustical Units	2.1	G DO												
			SD-06 Test Reports														
			Fire Resistive Ceilings														
			Ceiling Attenuation Class and Test	1.3.1													
			SD-07 Certificates														
			Acoustical Units	2.1													
		09650	SD-02 Shop Drawings														
			Sheet Flooring	2.2	G AO												
			Tile Flooring	2.1	G AO												
			SD-03 Product Data														
			Tile Flooring	2.1	G DO												
			Sheet Flooring	2.2	G DO												
			Accessories for Sheet Vinyl	2.2.4	G DO												
			Integral Coved Base	2.2.2	G DO												
			Adhesive for Sheet Vinyl		G AO												
			Adhesive for Vinyl Composition	2.1.2	G AO												
			Tile														
			Adhesive for Wall Base	2.4.2	G AO												
			SD-04 Samples														
			Tile Flooring	2.1	G DO												
			Sheet Flooring	2.2	G DO												
			Weld Rod	2.2.1.2	G DO												
			Wall Base		G DO												

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		09650	Sheet Vinyl Cap Strip		G DO												
			Transition Strip		G DO												
			SD-06 Test Reports														
			Moisture Test	3.3	G AO												
			SD-08 Manufacturer's Instructions														
			Sheet Flooring	2.2	G AO												
			Tile Flooring	2.1	G AO												
			SD-10 Operation and Maintenance Data														
			Data Package 1		G AO												
		09680A	SD-02 Shop Drawings														
			Installation	3.4	G AO												
			Molding	2.3	G AO												
			SD-03 Product Data														
			Carpet		G DO												
			Surface Preparation	3.1	G AO												
			Installation	3.4	G AO												
			SD-04 Samples														
			Carpet		G DO												
			Molding	2.3	G DO												
			SD-06 Test Reports														
			Moisture and Alkalinity Tests	3.2	G AO												
			SD-07 Certificates														
			Carpet														
			Regulatory Requirements	1.3	G DO												

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		09680A	SD-10 Operation and Maintenance Data														
			Carpet														
			Cleaning and Protection	3.5													
		09720	SD-03 Product Data														
			Wallcoverings	2.1	G DO												
			Installation	3.3	G AO												
			Maintenance														
			Clean-Up	3.4													
			SD-04 Samples														
			Wallcoverings	2.1	G DO												
			SD-07 Certificates														
			Wallcoverings	2.1													
			SD-08 Manufacturer's Instructions														
			Wallcoverings	2.1													
			SD-10 Operation and Maintenance														
			Data														
			Wallcoverings	2.1	G AO												
		09900	SD-02 Shop Drawings														
			Piping identification	3.10	G DO												
			SD-03 Product Data														
			Coating	2.1	G DO												
			Manufacturer's Technical Data	2.1	G DO												
			Sheets;														
			SD-04 Samples														
			Color	1.9	G DO												

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		09900	SD-07 Certificates														
			Applicator's qualifications;	1.3													
			Qualification Testing	1.4.1.2													
			SD-08 Manufacturer's Instructions														
			Application instructions;	3.2.1													
			Mixing;	3.6.2													
			Manufacturer's Material Safety	1.7.2													
			Data Sheets														
			SD-10 Operation and Maintenance														
			Data														
			Coatings	2.1													
		09965A	SD-03 Product Data														
			Safety and Health Provisions	1.5	G A												
			Respirators	1.5.6.1	G A1												
			SD-04 Samples														
			Paint Formulations		G A1												
			Solvent and Thinners		G A1												
			Inspection	3.4	G A												
			SD-07 Certificates														
			Qualifications	1.3	G A1												
			Coating System Component		G A1												
			Compatibility														
			Qualified Painting Contractor	1.3.2	G A1												
			Coating Thickness Gage	1.3.4	G A												
			Qualification														
		10100A	SD-03 Product Data														

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		10100A	Visual Communication Specialties 07 Certificates		G DO												
		10153	SD-02 Shop Drawings Toilet Partition System		G DO												
			SD-03 Product Data Toilet Partition System		G DO												
			SD-04 Samples Toilet Partition System		G DO												
		10270A	SD-03 Product Data Fiberglass Grating Panels		G AO												
		10430	SD-02 Shop Drawings Approved Detail Drawings	3.1	G AO												
			SD-03 Product Data Exterior Signage System		G AO												
			Installation	3.1	G AO												
			Wind Load Requirements	1.3	G DO												
			SD-04 Samples Exterior Signs		G AO												
			SD-10 Operation and Maintenance Data														
			Protection and Cleaning	3.1.2													
		10440	SD-02 Shop Drawings Detail Drawings	3.1	G DO												
			SD-03 Product Data Installation	3.1	G DO												
			SD-04 Samples														

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		10440	Interior Signage	1.3	G DO												
			SD-10 Operation and Maintenance Data														
			Approved Manufacturer's Instructions	3.1	G AO												
			Protection and Cleaning	3.1.3													
		10505N	SD-02 Shop Drawings														
			Types	2.1	G DO												
			Location	2.1	G DO												
			Installation;	3.1	G AO												
			Numbering system	3.2	G DO												
			SD-03 Product Data														
			Material;	2.2	G DO												
			Finish;	2.2.3	G DO												
			Components;	2.3	G DO												
			Assembly	3.1	G AO												
			SD-04 Samples														
			Color chips	1.5.1	G DO												
		10522	SD-03 Product Data														
			Fire Extinguisher Cabinet		G DO												
			SD-08 Manufacturer's Instructions														
			Manufacturer's Installation Instructions														
		10650A	SD-02 Shop Drawings														
			Operable Partitions	2.2	G DO												
			SD-03 Product Data														

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		10650A	Operable Partitions	2.2	G DO												
			SD-04 Samples														
			Operable Partitions	2.2	G DO												
			SD-07 Certificates														
			Materials	2.1													
			Operable Partitions	2.2													
			SD-10 Operation and Maintenance Data														
			Operable Partitions	2.2	G AO												
		10800	SD-03 Product Data														
			Finishes	2.1.2	G DO												
			Accessory Items	2.2	G DO												
			SD-04 Samples														
			Finishes	2.1.2	G DO												
			Accessory Items	2.2	G DO												
			SD-07 Certificates														
			Accessory Items	2.2													
			SD-10 Operation and Maintenance Data														
			Electric Hand Dryer	2.2.15	G DO												
		11211A	SD-02 Shop Drawings														
			Installation	3.1	G DO												
			SD-03 Product Data														
			Materials and Equipment	2.1	G DO												
			Instructions	3.5	G AO												
			SD-06 Test Reports														

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		11211A	Tests	3.2	G AO												
			SD-10 Operation and Maintenance Data														
			Centrifugal Pump System		G AO												
		11242A	SD-02 Shop Drawings														
			Installation	3.1	G DO												
			SD-03 Product Data														
			Chemical Feed Systems	1.3	G DO												
			Material Safety Data Sheet		G AO												
			SD-06 Test Reports														
			Field Testing	3.3	G AO												
			SD-10 Operation and Maintenance Data														
			Chemical Feed Systems	1.3	G AO												
		11301A	SD-02 Shop Drawings														
			Materials and Equipment	1.7.1	G DO												
			SD-03 Product Data														
			Packed Column System	1.5.1	G DO												
			Equipment	3.1	G AO												
			SD-06 Test Reports														
			Tests	3.2	G AO												
			SD-10 Operation and Maintenance Data														
			Packed Column System	1.5.1	G DO												
			Maintenance		G DO												
		11310A	SD-02 Shop Drawings														

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		11310A	Equipment Installation	3.1	G DO												
			SD-03 Product Data														
			Submersible Centrifugal Pump System		G DO												
			Spare Parts		G AO												
			SD-06 Test Reports														
			Field Testing and Adjusting Equipment	3.3	G AO												
			SD-10 Operation and Maintenance Data														
			Submersible Centrifugal Pump System		G AO												
		11376	SD-02 Shop Drawings														
			Layout	2.2.1	G DO												
			Installation	3.1	G DO												
			SD-03 Product Data														
			Ultraviolet Disinfection Equipment		G DO												
			Framed Instructions	2.4	G AO												
			Field Training	3.2.3	G AO												
			Equipment	2.2	G DO												
			Adjusting and Cleaning	3.3	G DO												
			SD-06 Test Reports														
			Laboratory Tests		G DO												
			Testing	3.4	G AO												
			SD-07 Certificates														
			Manufacturer's Qualifications	1.4.2	G DO												

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		11376	Standard Products	2.2.2	G DO												
			SD-10 Operation and Maintenance Data														
			UV Disinfection System		G DO												
		11377	SD-02 Shop Drawings														
			Layout		G DO												
			Installation		G DO												
			SD-03 Product Data														
			Disc Filtration Equipment		G DO												
			Equipment		G DO												
			Adjusting and Cleaning		G DO												
			SD-06 Test Reports														
			Testing		G AO												
			SD-10 Operation and Maintenance Data														
			Disc Filtration System		G DO												
		11378	SD-02 Shop Drawings														
			Layout		G DO												
			Installation		G DO												
			SD-03 Product Data														
			Hatchery Equipment		G DO												
			Equipment		G DO												
			Adjusting and Cleaning		G DO												
			SD-10 Operation and Maintenance Data														
			Hatchery Equipment Systems		G AO												

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		11393	SD-02 Shop Drawings														
			Shop Drawings		G DO												
			SD-03 Product Data														
			Posting Framed Instructions	3.6	G AO												
			Control System	2.2.2	G DO												
			Spare Parts	2.6	G AO												
			SD-06 Test Reports														
			Acceptance Testing	3.7.3	G AO												
			SD-10 Operation and Maintenance Data														
			Field Training	3.8	G AO												
		11400A	SD-02 Shop Drawings														
			Walk-In Refrigeration Equipment Installation	3.1	G DO												
			SD-03 Product Data														
			Food Service Equipment		G DO												
			SD-06 Test Reports														
			Testing	3.3													
			SD-10 Operation and Maintenance Data														
			Food Service Equipment														
		11401N	SD-03 Product Data														
			Kitchen and laundry room equipment		G DO												
			SD-04 Samples														

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		11401N	Kitchen and laundry room equipment		G DO												
			SD-08 Manufacturer's Instructions														
			Kitchen and laundry room equipment		G DO												
			SD-10 Operation and Maintenance Data														
			Kitchen and laundry room equipment		G DO												
		12490A	SD-02 Shop Drawings														
			Approved Detail Drawings	3.2	G AO												
			SD-03 Product Data														
			Window Treatments	3.2	G DO												
			Hardware	1.3	G DO												
			SD-04 Samples														
			Window Treatments	3.2	G DO												
		12690	SD-03 Product Data														
			Finishes		G DO												
			Accessory Items		G DO												
			SD-02 Shop Drawings														
			Entrance Mats		G DO												
			SD-06 Test Reports														
			Entrance Mats		G DO												
			SD-04 Samples														
			Finishes		G DO												
		12705	SD-02 Shop Drawings														

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ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION REVISION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS	
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE			DATE OF ACTION
		12705	Approved Detail Drawings		G DO												
			Installation	3.1	G DO												
			SD-03 Product Data														
			Installation Instructions	3.1	G DO												
			Warranty	1.7	G AO												
			Workstation Components		G DO												
			SD-04 Samples														
			Workstations		G DO												
			SD-06 Test Reports														
			Selected Components	2.1.1	G DO												
			Panel Acoustics	2.1.2	G DO												
			Fire Safety	2.1.3	G DO												
			Electrical System	2.1.5	G DO												
			SD-07 Certificates														
			Workstations		G AO												
			SD-10 Operation and Maintenance														
			Data														
			Product Assembly Manual		G AO												
			Product Maintenance Manuals		G AO												
			Cleaning	3.2	G AO												
		13110A	SD-02 Shop Drawings														
			Drawings	1.3.8	G DO												
			Contractor's Modifications	1.3.2	G AO												
			SD-03 Product Data														
			Equipment		G DO												
			Spare Parts	3.8	G AO												

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Fish Hatchery - Rearing Ponds and Hatchery Complex																	
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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		13110A	SD-06 Test Reports														
			Tests and Measurements	3.5	G AO												
			Contractor's Modifications	1.3.2	G AO												
			SD-07 Certificates														
			Cathodic Protection System														
			Services of 'Corrosion Expert'	1.3.1	G DO												
			SD-10 Operation and Maintenance Data														
			Cathodic Protection System														
		13120	SD-02 Shop Drawings														
			Metal Building Systems		G DO												
			SD-04 Samples														
			Accessories	2.2.6	G DO												
			Siding	2.2	G DO												
			Fasteners	2.3	G DO												
			Insulation		G DO												
			SD-05 Design Data														
			Design Analysis	1.4	G DO												
			Instruction Manuals		G DO												
			SD-07 Certificates														
			Metal Building Systems														
			Insulation														
		13210A	SD-02 Shop Drawings														
			Tank Installation	3.1	G DO												
			SD-03 Product Data														
			General Requirements	1.3	G DO												

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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		13210A	SD-06 Test Reports														
			Tank Installation	3.1	G AO												
			SD-07 Certificates														
			General Requirements	1.3	G AO												
		13401N	SD-03 Product Data														
			GA-DO														
			equipment	2.1													
			Read-out device	2.2													
			SD-06 Test Reports														
			calibration														
			SD-08 Manufacturer's Instructions														
			equipment	2.1													
		13405A	SD-02 Shop Drawings														
			Installation	3.1.1	G DO												
			Wiring	3.1.1	G DO												
			SD-03 Product Data														
			Instrumentation and Control	3.6	G DO												
			System														
			Sensors and Meters		G DO												
			Training Manual	3.7	G AO												
			Performance Verification Test	3.4.2	G AO												
			(PVT)														
			Factory Test Procedure		G AO												
			SD-06 Test Reports														
			Factory Test Report		G AO												

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		13405A	Testing, Adjusting and Commissioning	3.4.1	G AO												
			Performance Verification Test(PVT)	3.4.2	G AO												
			Endurance Test	3.4.3	G AO												
			SD-07 Certificates														
			Control and Sensor Wiring	3.3.1.2	G AO												
			Ground Rods	3.4.1	G AO												
			SD-10 Operation and Maintenance Data														
			Instrumentation and Control System	3.6	G AO												
		13851A	SD-02 Shop Drawings														
			Fire Alarm Reporting System	1.4.1													
			SD-03 Product Data														
			Storage Batteries	2.2	G DO												
			Voltage Drop		G DO												
			Special Tools and Spare Parts	2.7.4	G AO												
			Technical Data and Computer Software	1.5	G DO												
			Training	3.5	G AO												
			Testing	3.4	G AO												
			SD-06 Test Reports														
			Testing	3.4	G AO												
			SD-07 Certificates														
			Equipment		G DO												

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		13851A	Qualifications	1.3.7	G DO												
			SD-10 Operation and Maintenance Data														
			Technical Data and Computer Software	1.5	G DO												
		13930A	SD-02 Shop Drawings														
			Shop Drawings	1.12	G DO												
			As-Built Drawings	3.11													
			SD-03 Product Data														
			Fire Protection Related Submittals	3.1	G AO												
			Sway Bracing	3.4.1	G DO												
			Materials and Equipment	2.3	G DO												
			Hydraulic Calculations	1.7	G DO												
			Spare Parts	1.11													
			Preliminary Tests	3.10	G AO												
			Final Acceptance Test	3.11	G AO												
			On-site Training	3.12	G AO												
			Fire Protection Specialist	1.8	G DO												
			Sprinkler System Installer	1.9	G DO												
			SD-06 Test Reports														
			Preliminary Test Report	3.11	G AO												
			Final Acceptance Test Report	3.11	G AO												
			SD-07 Certificates														
			Inspection by Fire Protection Specialist	3.3	G AO												

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		13930A	SD-10 Operation and Maintenance Data														
			Operation and Maintenance Instructions		G AO												
		14534N	SD-02 Shop Drawings Jib crane system		G DO												
			SD-10 Operation and Maintenance Data														
			Hoist and trolley	2.1													
		15080A	SD-02 Shop Drawings Mica Plates	3.2.2.4	G AO												
			SD-03 Product Data General Materials	2.1	G DO												
			SD-04 Samples Thermal Insulation Materials		G AO												
		15190A	SD-02 Shop Drawings Gas Piping System	3.2													
			SD-03 Product Data Qualifications		G AO												
			SD-06 Test Reports Testing		G AO												
			Pressure Tests	3.16.1	G AO												
		15200A	SD-02 Shop Drawings Pipe and Equipment	3.1.1	G DO												
			SD-03 Product Data Waste Water Disposal	3.15	G AO												

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		15200A	Delivery, Storage and Handling Materials and Equipment	1.6	G AO													
			Installation	1.9.2	G AO													
			Pipe Schedule		G DO													
			Valve Schedule	2.8.2	G DO													
			Operator Schedule	2.8.9.1	G DO													
			SD-06 Test Reports															
			Pipe Leakage Tests	3.13.2	G AO													
			Hydrostatic Tests	3.13.1	G AO													
			Pneumatic Tests		G AO													
			Valve Testing	3.13.4	G AO													
			Disinfection		G AO													
			SD-10 Operation and Maintenance Data															
			Piping and Appurtenances	3.2	G AO													
		15400A	SD-02 Shop Drawings															
			Plumbing System	3.9.1	G DO													
			SD-03 Product Data															
			Welding	1.5.1	G AO													
			Plumbing Fixture Schedule	3.10	G DO													
			Vibration-Absorbing Features	3.4	G AO													
			Plumbing System	3.9.1	G AO													
			SD-06 Test Reports															
			Tests, Flushing and Disinfection	3.9	G AO													
			Backflow Prevention Assembly Tests		G AO													

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		15400A	SD-07 Certificates														
			Materials and Equipment		G AO												
			Bolts	2.1.1	G AO												
			SD-10 Operation and Maintenance														
			Data														
			Plumbing System	3.9.1	G AO												
		15556A	SD-02 Shop Drawings														
			Heating System		G DO												
			SD-03 Product Data														
			Spare Parts		G AO												
			Welding		G AO												
			Framed Instructions	3.18	G AO												
			SD-06 Test Reports														
			Testing and Cleaning	3.16	G AO												
			Water Treatment Testing		G AO												
			SD-07 Certificates														
			Bolts		G AO												
			SD-10 Operation and Maintenance														
			Data														
			Heating System		G AO												
		15569A	SD-02 Shop Drawings														
			Heating System		G DO												
			Piping Installation	3.2	G AO												
			Installation	3.2.6.4													
			Installation	3.2.12													
			SD-03 Product Data														

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		15569A	Manufacturer's Catalog Data		G DO												
			Spare Parts Data														
			Water Treatment Plan		G DO												
			Boiler Water Treatment	2.15	G DO												
			Heating System Tests	3.8	G AO												
			Fuel System Tests	3.10	G DO												
			Welding	1.3.6	G AO												
			Qualification		G AO												
			Field Instructions	3.11	G AO												
			Tests	3.3	G AO												
			SD-06 Test Reports														
			Heating System Tests	3.8	G DO												
			Fuel System Tests	3.10	G DO												
			Water Treatment Tests		G DO												
			SD-07 Certificates														
			Bolts	2.10.12.3	G AO												
			Continuous Emissions Monitoring		G AO												
			SD-10 Operation and Maintenance Data														
			Heating System		G DO												
			Water Treatment System	2.15	G DO												
		15700A	SD-02 Shop Drawings														
			Drawings		G DO												
			SD-03 Product Data														
			Unitary Equipment	2.4	G DO												
			Spare Parts Data														

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		15700A	Posted Instructions	3.5	G AO												
			Verification of Dimensions	1.5.1	G AO												
			System Performance Tests	3.4	G AO												
			Demonstrations	3.5	G AO												
			SD-06 Test Reports														
			Refrigerant Tests, Charging, and Start-Up	3.3	G AO												
			System Performance Tests	3.4	G AO												
			SD-07 Certificates														
			Unitary Equipment	2.4	G DO												
			Service Organization	2.1													
			SD-10 Operation and Maintenance Data														
			Operation Manuals		G AO												
			Maintenance Manuals	3.5	G AO												
		15768N	SD-02 Shop Drawings														
			Heater installation drawing	3.1	G DO												
			SD-03 Product Data														
			Electric unit heaters	2.1	G DO												
			Unit thermostat		G DO												
			SD-10 Operation and Maintenance Data														
			Electric unit heaters	2.1	G AO												
		15895	SD-02 Shop Drawings														
			Drawings	3.1.9	G DO												
			Installation	3.1	G AO												

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		15895	SD-03 Product Data														
			Components and Equipment	2.1	G DO												
			Test Procedures		G AO												
			Welding Procedures		G AO												
			Diagrams	3.1	G AO												
			Manufacturer's Experience	2.1	G AO												
			Welded Joints		G AO												
			Performance Tests	3.7	G AO												
			Field Training	3.9	G AO												
			SD-06 Test Reports														
			Performance Tests	3.7	G AO												
			Testing, Adjusting, and Balancing	3.6	G AO												
			SD-07 Certificates														
			Bolts		G AO												
			SD-10 Operation and Maintenance														
			Data														
			Operating and Maintenance	3.9	G AO												
			Instructions														
		15951A	SD-02 Shop Drawings														
			HVAC Control System	3.1.1	G DO												
			SD-03 Product Data														
			Service Organizations		G AO												
			Equipment Compliance Booklet	1.6	G DO												
			Commissioning Procedures	3.4	G AO												
			Performance Verification Test	1.6	G AO												
			Procedures														

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		15951A	Training	3.6	G AO												
			SD-06 Test Reports														
			Commissioning Report	3.6.2	G AO												
			Performance Verification Test	3.5.3	G AO												
			SD-10 Operation and Maintenance Data														
			Operation Manual	1.5	G AO												
			Maintenance and Repair Manual	1.6	G AO												
		15990A	SD-02 Shop Drawings														
			TAB Schematic Drawings and Report Forms	3.3	G AO												
			SD-03 Product Data														
			TAB Related HVAC Submittals	3.2													
			TAB Procedures	3.5.1	G AO												
			Calibration	1.4													
			Systems Readiness Check	3.5.2													
			TAB Execution	3.5.1	G AO												
			TAB Verification	3.5.4	G AO												
			SD-06 Test Reports														
			Design Review Report	3.1	G AO												
			Systems Readiness Check	3.5.2	G AO												
			TAB Report	3.5.3	G AO												
			TAB Verification Report	3.5.4	G AO												
			SD-07 Certificates														
			TAB Firm	1.5.1	G AO												
			TAB Specialist	1.5.2	G AO												

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		16261A	SD-02 Shop Drawings														
			Schematic diagrams	1.5.1	G DO												
			Interconnecting diagrams	1.5.2	G DO												
			Installation drawings	1.5.3	G AO												
			SD-03 Product Data														
			Variable frequency drives	2.1	G DO												
			Wires and cables	2.3	G DO												
			Equipment schedule	1.5.4	G DO												
			SD-06 Test Reports														
			VFD Test	3.2.1	G AO												
			Test Plan		G AO												
			Performance Verification Tests	3.2.2	G AO												
			Endurance Test		G AO												
			SD-08 Manufacturer's Instructions														
			Installation instructions	1.5.5	G AO												
			SD-09 Manufacturer's Field Reports														
			VFD Factory Test Plan		G AO												
			Total Harmonic Distortion Analysis		G AO												
			SD-10 Operation and Maintenance Data														
			Variable frequency drives	2.1	G AO												
		16375A	SD-02 Shop Drawings														
			Electrical Distribution System	3.10.3	G DO												
			SD-03 Product Data														

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		16375A	Fault Current Analysis	2.16.4	G DO												
			Protective Device	2.16	G DO												
			Coordination Study	2.16.5	G DO												
			Nameplates	2.2	G AO												
			Material and Equipment	2.1	G AO												
			General Installation Requirements	3.1	G AO												
			SD-06 Test Reports														
			Field Testing	3.10	G AO												
			Operating Tests	3.10.6	G AO												
			Cable Installation	3.2.1.4	G AO												
			SD-07 Certificates														
			Material and Equipment	2.1	G AO												
			Cable Joints	3.3	G AO												
			Cable Installer Qualifications		G AO												
			SD-10 Operation and Maintenance Data														
			Electrical Distribution System	3.10.3	G AO												
		16415A	SD-02 Shop Drawings														
			Interior Electrical Equipment		G DO												
			SD-03 Product Data														
			Fault Current and Protective Device Coordination Study		G DO												
			Manufacturer's Catalog		G DO												
			Material, Equipment, and Fixture Lists		G AO												
			Installation Procedures		G AO												

# SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION Fish Hatchery - Rearing Ponds and Hatchery Complex						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY					REMARKS	
						DATE SUBMITTED	DATE APPROVAL NEEDED	DATE MATERIAL NEEDED	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		DATE RCD FRM APPR AUTH
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		16415A	Onsite Tests	3.21.2	G AO												
			Field Test Plan		G AO												
			Field Test Reports	3.19	G AO												
			SD-07 Certificates														
			Materials and Equipment	1.4	G AO												
		16528A	SD-02 Shop Drawings														
			Lighting System	1.3.1	G AO												
			Detail Drawings		G AO												
			SD-03 Product Data														
			Equipment and Materials		G AO												
			Spare Parts		G AO												
			Operating Test	3.10.1	G AO												
			Ground Resistance	3.10.2	G AO												
			Measurements														
			SD-10 Operation and Maintenance														
			Data														
			Lighting System	1.3.1	G AO												
		16710A	SD-02 Shop Drawings														
			Premises Distribution System	1.7	G DO												
			Installation	3.1	G AO												
			SD-03 Product Data														
			Record Keeping and	1.8	G AO												
			Documentation														
			Spare Parts	3.1.8	G AO												
			Manufacturer's Recommendations	3.1.2	G AO												
			Test Plan	3.6	G AO												



**TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE**

*(Read instructions on the reverse side prior to initiating this form)*

DATE

TRANSMITTAL NO.

**SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS** *(This section will be initiated by the contractor)*

TO:	FROM:	CONTRACT NO.	CHECK ONE: <input type="checkbox"/> THIS IS A NEW TRANSMITTAL <input type="checkbox"/> THIS IS A RESUBMITTAL OF TRANSMITTAL _____
SPECIFICATION SEC. NO. <i>(Cover only one section with each transmittal)</i>	PROJECT TITLE AND LOCATION		CHECK ONE: THIS TRANSMITTAL IS FOR <input type="checkbox"/> FIO <input type="checkbox"/> GOV'T. APPROVAL

ITEM NO.	DESCRIPTION OF ITEM SUBMITTED <i>(Type size, model number/etc.)</i>	MFG OR CONTR. CAT., CURVE DRAWING OR BROCHURE NO. <i>(See instruction no. 8)</i>	NO. OF COPIES	CONTRACT REFERENCE DOCUMENT		FOR CONTRACTOR USE CODE	VARIATION <i>(See instruction No. 6)</i>	FOR CE USE CODE
				SPEC. PARA. NO.	DRAWING SHEET NO.			
a.	b.	c.	d.	e.	f.	g.	h.	i.

REMARKS	I certify that the above submitted items have been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications except as other wise stated.  _____ NAME AND SIGNATURE OF CONTRACTOR
---------	---

**SECTION II - APPROVAL ACTION**

ENCLOSURES RETURNED <i>(List by Item No.)</i>	NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY	DATE
---	--	------

## INSTRUCTIONS

1. Section I will be initiated by the Contractor in the required number of copies.
2. Each transmittal shall be numbered consecutively in the space provided for "Transmittal No.". This number, in addition to the contract number, will form a serial number for identifying each submittal. For new submittals or resubmittals mark the appropriate box; on resubmittals, insert transmittal number of last submission as well as the new submittal number.
3. The "Item No." will be the same "Item No." as indicated on ENG FORM 4288-R for each entry on this form.
4. Submittals requiring expeditious handling will be submitted on a separate form.
5. Separate transmittal form will be used for submittals under separate sections of the specifications.
6. A check shall be placed in the "Variation" column when a submittal is not in accordance with the plans and specifications--also, a written statement to that effect shall be included in the space provided for "Remarks".
7. Form is self-transmittal, letter of transmittal is not required.
8. When a sample of material or Manufacturer's Certificate of Compliance is transmitted, indicate "Sample" or "Certificate" in column c, Section I.
9. U.S. Army Corps of Engineers approving authority will assign action codes as indicated below in space provided in Section I, column i to each item submitted. In addition they will ensure enclosures are indicated and attached to the form prior to return to the contractor. The Contractor will assign action codes as indicated below in Section I, column g, to each item submitted.

### THE FOLLOWING ACTION CODES ARE GIVEN TO ITEMS SUBMITTED

A	--	Approved as submitted.	E	--	Disapproved (See attached).
B	--	Approved, except as noted on drawings.	F	--	Receipt acknowledged.
C	--	Approved, except as noted on drawings. Refer to attached sheet resubmission required.	FX	--	Receipt acknowledged, does not comply as noted with contract requirements.
D	--	Will be returned by separate correspondence.	G	--	Other ( <i>Specify</i> )

10. Approval of items does not relieve the contractor from complying with all the requirements of the contact plans and specifications.

*(Reverse of ENG Form 4025-R)*

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SECTION 01355

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10/00

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## SECTION 01355

ENVIRONMENTAL PROTECTION  
10/00

## PART 1 GENERAL

Attachment: Application for Beneficial Water Use Permit for State of Montana

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AIR FORCE INSTRUCTION

AFI 32-1053 Pest Management Program

## ARMY REGULATION

AR 200-5 Pest Management

## CODE OF FEDERAL REGULATIONS (CFR)

33 CFR 328 Definitions  
40 CFR 68 Chemical Accident Prevention Provisions  
40 CFR 152 - 186 Pesticide Programs  
40 CFR 260 Hazardous Waste Management System: General  
40 CFR 261 Identification and Listing of Hazardous Waste  
40 CFR 262 Standards Applicable to Generators of Hazardous Waste  
40 CFR 279 Standards for the Management of Used Oil  
40 CFR 302 Designation, Reportable Quantities, and Notification  
40 CFR 355 Emergency Planning and Notification  
49 CFR 171 - 178 Hazardous Materials Regulations

## ENGINEERING MANUALS (EM)

EM 385-1-1 (1996) U.S. Army Corps on Engineers Safety and Health Requirements Manual

## US ARMY CORPS OF ENGINEERS TECHNICAL REPORT

## WETLAND MANUAL

Corps of Engineers Wetlands Delineation  
Manual Technical Report Y-87-1

## 1.2 DEFINITIONS

## 1.2.1 Environmental Pollution and Damage

Environmental pollution and damage is the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the environment aesthetically, culturally and/or historically.

## 1.2.2 Environmental Protection

Environmental protection is the prevention/control of pollution and habitat disruption that may occur to the environment during construction. The control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

## 1.2.3 Contractor Generated Hazardous Waste

Contractor generated hazardous waste means materials that, if abandoned or disposed of, may meet the definition of a hazardous waste. These waste streams would typically consist of material brought on site by the Contractor to execute work, but are not fully consumed during the course of construction. Examples include, but are not limited to, excess paint thinners (i.e. methyl ethyl ketone, toluene etc.), waste thinners, excess paints, excess solvents, waste solvents, and excess pesticides, and contaminated pesticide equipment rinse water.

## 1.2.4 Land Application for Discharge Water

The term "Land Application" for discharge water implies that the Contractor shall discharge water at a rate which allows the water to percolate into the soil. No sheeting action, soil erosion, discharge into storm sewers, discharge into defined drainage areas, or discharge into the "waters of the United States" shall occur. Land Application shall be in compliance with all applicable Federal, State, and local laws and regulations.

## 1.2.5 Pesticide

Pesticide is defined as any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest, or intended for use as a plant regulator, defoliant or desiccant.

## 1.2.6 Pests

The term "pests" means arthropods, birds, rodents, nematodes, fungi, bacteria, viruses, algae, snails, marine borers, snakes, weeds and other organisms (except for human or animal disease-causing organisms) that adversely affect readiness, military operations, or the well-being of personnel and animals; attack or damage real property, supplies, equipment, or vegetation; or are otherwise undesirable.

### 1.2.7 Surface Discharge

The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers, creeks, and/or "waters of the United States" and would require a permit to discharge water from the governing agency.

### 1.2.8 Waters of the United States

All waters which are under the jurisdiction of the Clean Water Act, as defined in 33 CFR 328.

### 1.2.9 Wetlands

Wetlands means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, and bogs. Official determination of whether or not an area is classified as a wetland must be done in accordance with WETLAND MANUAL.

## 1.3 GENERAL REQUIREMENTS

The Contractor shall minimize environmental pollution and damage that may occur as the result of construction operations. The environmental resources within the project boundaries and those affected outside the limits of permanent work shall be protected during the entire duration of this contract. The Contractor shall comply with all applicable environmental Federal, State, and local laws and regulations. The Contractor shall be responsible for any delays resulting from failure to comply with environmental laws and regulations.

## 1.4 SUBCONTRACTORS

The Contractor shall ensure compliance with this section by subcontractors.

## 1.5 PAYMENT

No separate payment will be made for work covered under this section. The Contractor shall be responsible for payment of fees associated with environmental permits, application, and/or notices obtained by the Contractor. All costs associated with this section shall be included in the contract price. The Contractor shall be responsible for payment of all fines/fees for violation or non-compliance with Federal, State, Regional and local laws and regulations.

## 1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Environmental Protection Plan; G-AO

The environmental protection plan.

#### 1.7 ENVIRONMENTAL PROTECTION PLAN

Prior to commencing construction activities or delivery of materials to the site, the Contractor shall submit an Environmental Protection Plan for review and approval by the Contracting Officer. The purpose of the Environmental Protection Plan is to present a comprehensive overview of known or potential environmental issues which the Contractor must address during construction. Issues of concern shall be defined within the Environmental Protection Plan as outlined in this section. The Contractor shall address each topic at a level of detail commensurate with the environmental issue and required construction task(s). Topics or issues which are not identified in this section, but which the Contractor considers necessary, shall be identified and discussed after those items formally identified in this section. Prior to submittal of the Environmental Protection Plan, the Contractor shall meet with the Contracting Officer for the purpose of discussing the implementation of the initial Environmental Protection Plan; possible subsequent additions and revisions to the plan including any reporting requirements; and methods for administration of the Contractor's Environmental Plans. The Environmental Protection Plan shall be current and maintained onsite by the Contractor.

##### 1.7.1 Compliance

No requirement in this Section shall be construed as relieving the Contractor of any applicable Federal, State, and local environmental protection laws and regulations. During Construction, the Contractor shall be responsible for identifying, implementing, and submitting for approval any additional requirements to be included in the Environmental Protection Plan.

##### 1.7.2 Contents

The environmental protection plan shall include, but shall not be limited to, the following:

- a. Name(s) of person(s) within the Contractor's organization who is(are) responsible for ensuring adherence to the Environmental Protection Plan.
- b. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site, if applicable.
- c. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.
- d. Description of the Contractor's environmental protection personnel training program.
- e. An erosion control plan which identifies the type and location of the erosion and sediment controls to be provided in Specification Section 01569 Montana MPDES Permit Requirements for Storm Water Discharge from Construction Sites.
- f. Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil

materials including methods to control runoff and to contain materials on the site.

g. Traffic control plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. Plan shall include measures to minimize the amount of mud transported onto paved public roads by vehicles or runoff.

h. Work area plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas including methods for protection of features to be preserved within authorized work areas.

i. The Spill Control plan shall include the procedures, instructions, and reports to be used in the event of an unforeseen spill of a substance regulated by 40 CFR 68, 40 CFR 302, 40 CFR 355, and/or regulated under State or Local laws and regulations. The Spill Control Plan supplements the requirements of EM 385-1-1. This plan shall include as a minimum:

1. The name of the individual who will report any spills or hazardous substance releases and who will follow up with complete documentation. This individual shall immediately notify the Contracting Officer and the local Fire Department in addition to the legally required Federal, State, and local reporting channels (including the National Response Center 1-800-424-8802) if a reportable quantity is released to the environment. The plan shall contain a list of the required reporting channels and telephone numbers.

2. The name and qualifications of the individual who will be responsible for implementing and supervising the containment and cleanup.

3. Training requirements for Contractor's personnel and methods of accomplishing the training.

4. A list of materials and equipment to be immediately available at the job site, tailored to cleanup work of the potential hazard(s) identified.

5. The names and locations of suppliers of containment materials and locations of additional fuel oil recovery, cleanup, restoration, and material-placement equipment available in case of an unforeseen spill emergency.

6. The methods and procedures to be used for expeditious contaminant cleanup.

j. A non-hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris. The plan shall include schedules for disposal. The Contractor shall identify any subcontractors responsible for the transportation and disposal of solid waste. Licenses or permits shall be submitted for solid waste disposal sites that are not a commercial operating facility. Evidence of the disposal facility's acceptance of the solid waste shall be attached to this plan during the construction.

k. A recycling and solid waste minimization plan with a list of

measures to reduce consumption of energy and natural resources. The plan shall detail the Contractor's actions to comply with and to participate in Federal, State, Regional, and local government sponsored recycling programs to reduce the volume of solid waste at the source.

l. An air pollution control plan detailing provisions to assure that dust, debris, materials, trash, etc., do not become air borne and travel off the project site.

m. A contaminant prevention plan that: identifies potentially hazardous substances to be used on the job site; identifies the intended actions to prevent introduction of such materials into the air, water, or ground; and details provisions for compliance with Federal, State, and local laws and regulations for storage and handling of these materials. In accordance with EM 385-1-1, a copy of the Material Safety Data Sheets (MSDS) and the maximum quantity of each hazardous material to be on site at any given time shall be included in the contaminant prevention plan. As new hazardous materials are brought on site or removed from the site, the plan shall be updated.

n. A waste water management plan that identifies the methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines. If a settling/retention pond is required, the plan shall include the design of the pond including drawings, removal plan, and testing requirements for possible pollutants. If land application will be the method of disposal for the waste water, the plan shall include a sketch showing the location for land application along with a description of the pretreatment methods to be implemented. If surface discharge will be the method of disposal, a copy of the permit and associated documents shall be included as an attachment prior to discharging the waste water.

o. A historical, archaeological, cultural resources, biological resources, and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources, and wetlands known to be on the project site: and/or identifies procedures to be followed if historical archaeological, cultural resources, biological resources, and wetlands not previously known to be onsite or in the area are discovered during construction. The plan shall include methods to assure the protection of known or discovered resources and shall identify lines of communication between Contractor personnel and the Contracting Officer.

p. If applicable, a pesticide treatment plan shall be included and updated, as information becomes available. The plan shall include: sequence of treatment, dates, times, locations, pesticide trade name, EPA registration numbers, authorized uses, chemical composition, formulation, original and applied concentration, application rates of active ingredient (i.e. pounds of active ingredient applied), equipment used for application and calibration of equipment. The Contractor is responsible for Federal, State, Regional and Local pest management record keeping and reporting requirements. A copy of all reports shall be included in the Appendix to the Environmental Protection Plan.

### 1.7.3 Appendix

Copies of all environmental permits, permit application packages, approvals to construct, notifications, certifications, reports, and termination documents shall be attached, as an appendix, to the Environmental Protection Plan.

#### 1.8 PROTECTION FEATURES

This paragraph supplements the Contract Clause PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS. Prior to start of any onsite construction activities, the Contractor and the Contracting Officer shall make a joint condition survey. Immediately following the survey, the Contractor shall prepare a brief report including a plan describing the features requiring protection under the provisions of the Contract Clauses, which are not specifically identified on the drawings as environmental features requiring protection along with the condition of trees, shrubs and grassed areas immediately adjacent to the site of work and adjacent to the Contractor's assigned storage area and access route(s), as applicable. This survey report shall be signed by both the Contractor and the Contracting Officer upon mutual agreement as to its accuracy and completeness. The Contractor shall protect those environmental features included in the survey report and any indicated on the drawings, regardless of interference which their preservation may cause to the Contractor's work under the contract.

#### 1.9 ENVIRONMENTAL ASSESSMENT OF CONTRACT DEVIATIONS

Any deviations, requested by the Contractor, from the drawings, plans and specifications which may have an environmental impact will be subject to approval by the Contracting Officer and may require an extended review, processing, and approval time. The Contracting Officer reserves the right to disapprove alternate methods, even if they are more cost effective, if the Contracting Officer determines that the proposed alternate method will have an adverse environmental impact.

#### 1.10 NOTIFICATION

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with Federal, State or local environmental laws or regulations, permits, and other elements of the Contractor's Environmental Protection plan. The Contractor shall, after receipt of such notice, inform the Contracting Officer of the proposed corrective action and take such action when approved by the Contracting Officer. The Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions shall be granted or equitable adjustments allowed to the Contractor for any such suspensions. This is in addition to any other actions the Contracting Officer may take under the contract, or in accordance with the Federal Acquisition Regulation or Federal Law.

### PART 2 PRODUCTS (NOT USED)

### PART 3 EXECUTION

#### 3.1 ENVIRONMENTAL PERMITS AND COMMITMENTS

This paragraph supplements the Contractor's responsibility under the contract clause "PERMITS AND RESPONSIBILITIES" to the extent that the Government has obtained or is in the process of obtaining the permit/certifications.

- a. Department of the Army Section 404 Authorization/Permit
- b. State of Montana Section 401 Water Quality Certification

c. Application for Beneficial Water Use Permit. An Application for Beneficial Water User Permit was forwarded to the State of Montana Fish and Wildlife Project Manager Gary Berlellotti (406-444-2447) for their completion and review. The Montana Fish and Wildlife will complete and sign the application and forward it to the Montana Department of Natural Resources and Conservation for their approval.

If during construction, a modification to the design of the permitted/approval system is required, the Contractor shall be responsible for submitting the modified documents to the Contracting Officer for submittal to the governing agency. The Contractor shall not implement the modification until approval has been received from the Contracting Officer.

See Section 01569 (MONTANA) NPDES PERMIT REQUIREMENTS FOR STORM WATER DISCHARGES FROM CONSTRUCTION SITES. NOTE: Effective March 2003 the requirement will change from 5 acres to 1 acre.

### 3.2 LAND RESOURCES

The Contractor shall confine all activities to areas defined by the drawings and specifications. Prior to the beginning of any construction, the Contractor shall identify any land resources to be preserved within the work area. Except in areas indicated on the drawings or specified to be cleared, the Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without approval. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless specifically authorized. The Contractor shall provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs. Stone, soil, or other materials displaced into uncleared areas shall be removed by the Contractor.

#### 3.2.1 Work Area Limits

Prior to commencing construction activities, the Contractor shall mark the areas that need not be disturbed under this contract. Isolated areas within the general work area which are not to be disturbed shall be marked or fenced. Monuments and markers shall be protected before construction operations commence. Where construction operations are to be conducted during darkness, any markers shall be visible in the dark. The Contractor's personnel shall be knowledgeable of the purpose for marking and/or protecting particular objects.

#### 3.2.2 Landscape

Trees, shrubs, vines, grasses, land forms and other landscape features indicated and defined on the drawings to be preserved shall be clearly identified by marking, fencing, or wrapping with boards, or any other approved techniques. The Contractor shall restore landscape features damaged or destroyed during construction operations outside the limits of the approved work area.

#### 3.2.3 Erosion and Sediment Controls

The Contractor shall be responsible for providing erosion and sediment

control measures in accordance with Federal, State, and local laws and regulations. The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's construction activities. The area of bare soil exposed at any one time by construction operations should be kept to a minimum. The Contractor shall construct or install temporary and permanent erosion and sediment control best management practices (BMPs) as specified in Section 01356 STORM WATER POLLUTION PREVENTION MEASURES. BMPs may include, but not be limited to, vegetation cover, stream bank stabilization, slope stabilization, silt fences, construction of terraces, interceptor channels, sediment traps, inlet and outfall protection, diversion channels, and sedimentation basins. Any temporary measures shall be removed after the area has been stabilized.

#### 3.2.4 Contractor Facilities and Work Areas

The Contractor's field offices, staging areas, stockpile storage, and temporary buildings shall be placed in areas designated on the drawings or as directed by the Contracting Officer. Temporary movement or relocation of Contractor facilities shall be made only when approved. Erosion and sediment controls shall be provided for on-site borrow and spoil areas to prevent sediment from entering nearby waters. Temporary excavation and embankments for plant and/or work areas shall be controlled to protect adjacent areas.

### 3.3 WATER RESOURCES

The Contractor shall monitor construction activities to prevent pollution of surface and ground waters. Toxic or hazardous chemicals shall not be applied to soil or vegetation unless otherwise indicated. All water areas affected by construction activities shall be monitored by the Contractor. For construction activities immediately adjacent to impaired surface waters, the Contractor shall be capable of quantifying sediment or pollutant loading to that surface water when required by State or Federally issued Clean Water Act permits.

#### 3.3.1 Wetlands

The Contractor shall not enter, disturb, destroy, or allow discharge of contaminants into any wetlands, except as authorized herein. Authorization to enter specific wetlands identified on the drawings shall not relieve the Contractor from any obligation to protect other wetlands within, adjacent to, or in the vicinity of the construction site and associated boundaries.

### 3.4 AIR RESOURCES

Equipment operation, activities, or processes performed by the Contractor shall be in accordance with all Federal and State air emission and performance laws and standards.

#### 3.4.1 Particulates

Dust particles, aerosols and gaseous by-products from construction activities, and processing and preparation of materials, such as from asphaltic batch plants, shall be controlled at all times, including weekends, holidays and hours when work is not in progress. The Contractor shall maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or outside the project boundaries free from particulates which would

cause the Federal, State, and local air pollution standards to be exceeded or which would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, baghouse, scrubbers, electrostatic precipitators or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp at all times. The Contractor must have sufficient, competent equipment available to accomplish these tasks. Particulate control shall be performed as the work proceeds and whenever a particulate nuisance or hazard occurs. The Contractor shall comply with all State and local visibility regulations.

#### 3.4.2 Odors

Odors from construction activities shall be controlled at all times. The odors shall not cause a health hazard and shall be in compliance with State regulations and/or local ordinances.

#### 3.4.3 Sound Intrusions

The Contractor shall keep construction activities under surveillance and control to minimize environment damage by noise. The Contractor shall comply with the provisions of the State.

#### 3.4.4 Burning

Burning will not be allowed on the project site unless specified in other sections of the specifications or authorized in writing by the Contracting Officer. The specific time, location, and manner of burning shall be subject to approval.

### 3.5 CHEMICAL MATERIALS MANAGEMENT AND WASTE DISPOSAL

Disposal of wastes shall be as directed below, unless otherwise specified in other sections and/or shown on the drawings.

#### 3.5.1 Solid Wastes

Solid wastes (excluding clearing debris) shall be placed in containers which are emptied on a regular schedule. Handling, storage, and disposal shall be conducted to prevent contamination. Segregation measures shall be employed so that no hazardous or toxic waste will become co-mingled with solid waste. The Contractor shall transport solid waste off Government property and dispose of it in compliance with Federal, State, and local requirements for solid waste disposal. A Subtitle D RCRA permitted landfill shall be the minimum acceptable off-site solid waste disposal option. The Contractor shall verify that the selected transporters and disposal facilities have the necessary permits and licenses to operate.

#### 3.5.2 Chemicals and Chemical Wastes

Chemicals shall be dispensed ensuring no spillage to the ground or water. Periodic inspections of dispensing areas to identify leakage and initiate corrective action shall be performed and documented. This documentation will be periodically reviewed by the Government. Chemical waste shall be collected in corrosion resistant, compatible containers. Collection drums shall be monitored and removed to a staging or storage area when contents are within 6 inches of the top. Wastes shall be classified, managed, stored, and disposed of in accordance with Federal, State, and local laws and regulations.

### 3.5.3 Contractor Generated Hazardous Wastes/Excess Hazardous Materials

Hazardous wastes are defined in 40 CFR 261, or are as defined by applicable State and local regulations. Hazardous materials are defined in 49 CFR 171 - 178. The Contractor shall, at a minimum, manage and store hazardous waste in compliance with 40 CFR 262. The Contractor shall take sufficient measures to prevent spillage of hazardous and toxic materials during dispensing. The Contractor shall segregate hazardous waste from other materials and wastes, shall protect it from the weather by placing it in a safe covered location, and shall take precautionary measures such as berming or other appropriate measures against accidental spillage. The Contractor shall be responsible for storage, describing, packaging, labeling, marking, and placarding of hazardous waste and hazardous material in accordance with 49 CFR 171 - 178, State, and local laws and regulations.

The Contractor shall transport Contractor generated hazardous waste off Government property within 60 days in accordance with the Environmental Protection Agency and the Department of Transportation laws and regulations. The Contractor shall dispose of hazardous waste in compliance with Federal, State and local laws and regulations. Spills of hazardous or toxic materials shall be immediately reported to the Contracting Officer. Cleanup and cleanup costs due to spills shall be the Contractor's responsibility. The disposition of Contractor generated hazardous waste and excess hazardous materials are the Contractor's responsibility.

### 3.5.4 Fuel and Lubricants

Storage, fueling and lubrication of equipment and motor vehicles shall be conducted in a manner that affords the maximum protection against spill and evaporation. Fuel, lubricants and oil shall be managed and stored in accordance with all Federal, State, Regional, and local laws and regulations. Used lubricants and used oil to be discarded shall be stored in marked corrosion-resistant containers and recycled or disposed in accordance with 40 CFR 279, State, and local laws and regulations. There shall be no storage of fuel on the project site. Fuel must be brought to the project site each day that work is performed.

### 3.5.5 Waste Water

Disposal of waste water shall be as specified below.

- a. Waste water from construction activities, such as onsite material processing, concrete curing, foundation and concrete clean-up, water used in concrete trucks, forms, etc. shall not be allowed to enter water ways or to be discharged prior to being treated to remove pollutants. The Contractor shall dispose of the construction related waste water off-Government property in accordance with all Federal, State, Regional and Local laws and regulations.
- b. For discharge of ground water, the Contractor shall surface discharge if possible in accordance with the requirements of the NPDES or State STORM WATER DISCHARGES FROM CONSTRUCTION SITES permit or land apply on the project site. Land application shall be in accordance with all Federal, State, Regional, and/or Local laws and regulations for pumping and land applying ground water. Per the State of Montana a NPDES Storm Water Discharge from Construction Sites may be required if discharge is not land applied. The fee for the State of Montana NPDES Storm Water

Discharge from Construction Sites permit (Construction Dewatering) is \$300 for the application fee, and an annual fee of \$250. The Contractor shall be responsible for the applying for coverage under the permit. The Contractor shall be responsible for implementing the terms and requirements of the permit. All submissions to the State shall be by certified mail. This listing of requirements are not to be considered all-inclusive by the Contractor, but is provided as information that may be used in successfully accomplishing the environmental compliance. See Internet site <http://www.deq.state.mt.us/wqinfo/MPDES/StormwaterConstruction.asp>; Montana Department of Environmental Quality, Water Quality page.

- c. Water generated from the flushing of lines after disinfection or disinfection in conjunction with hydrostatic testing shall be land applied in accordance with all Federal, State, and local laws and regulations for land application.

### 3.6 RECYCLING AND WASTE MINIMIZATION

The Contractor shall participate in State and local government sponsored recycling programs.

### 3.7 HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

If during excavation or other construction activities any previously unidentified or unanticipated historical, archaeological, and cultural resources are discovered or found, all activities that may damage or alter such resources shall be temporarily suspended. Resources covered by this paragraph include but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rock or coral alignments, pavings, wall, or other constructed features; and any indication of agricultural or other historical human activities. Upon such discovery or find, the Contractor shall immediately notify the Contracting Officer so that the appropriate authorities may be notified and a determination made as to their significance and what, if any, special disposition of the finds should be made. The Contractor shall cease all activities that may result in impact to or the destruction of these resources. The Contractor shall secure the area and prevent employees or other persons from trespassing on, removing, or otherwise disturbing such resources.

### 3.8 BIOLOGICAL RESOURCES

The Contractor shall minimize interference with, disturbance to, and damage to fish, wildlife, and plants including their habitat. The Contractor shall be responsible for the protection of threatened and endangered animal and plant species including their habitat in accordance with Federal, State, Regional, and local laws and regulations.

### 3.9 PREVIOUSLY USED EQUIPMENT

The Contractor shall clean all previously used construction equipment prior to bringing it onto the project site. The Contractor shall ensure that the equipment is free from soil residuals, egg deposits from plant pests, noxious weeds, and plant seeds. The Contractor shall consult with the USDA jurisdictional office for additional cleaning requirements.

### 3.10 MAINTENANCE OF POLLUTION FACILITIES

The Contractor shall maintain permanent and temporary pollution control facilities and devices for the duration of the contract or for that length of time construction activities create the particular pollutant.

### 3.11 TRAINING OF CONTRACTOR PERSONNEL

The Contractor's personnel shall be trained in all phases of environmental protection and pollution control. The Contractor shall conduct environmental protection/pollution control meetings for all Contractor personnel prior to commencing construction activities. The Contractor shall maintain a list of attendees with date attended for these and all additional meetings. Additional meetings shall be conducted for new personnel and when site conditions change. The training and meeting agenda shall include: methods of detecting and avoiding pollution; familiarization with statutory and contractual pollution standards; installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental protection/pollution control; anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants; recognition and protection of archaeological sites, artifacts, wetlands, and endangered species and their habitat that are known to be in the area.

### 3.12 POST CONSTRUCTION CLEANUP

The Contractor shall clean up all areas used for construction in accordance with Contract Clause: "Cleaning Up". The Contractor shall, unless otherwise instructed in writing by the Contracting Officer, obliterate all signs of temporary construction facilities such as haul roads, work area, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. The disturbed area shall be graded, filled and the entire area seeded unless otherwise indicated.

-- End of Section --

# APPLICATION FOR BENEFICIAL WATER USE PERMIT

Use for groundwater in excess of 35 GPM or 10 Acre-Feet per year and all surface water.

### INSTRUCTIONS

Use one application for each source of supply or each development. Check all appropriate boxes and fill in each blank. If more space is needed, attach additional sheets. The information required in the Form 600 A or B Criteria Addendum must be submitted with this application.

Complete the application and submit it with the filing fee, payable to DNRC, to the Water Resources Regional Office nearest you. Their addresses are listed on the back. The estimated processing time after an application is correct and complete is 210 days.

**FILING FEE: \$200.00**

### FOR DEPARTMENT USE ONLY

Application No. \_\_\_\_\_ Basin \_\_\_\_\_  
Priority Date \_\_\_\_\_  
Time \_\_\_\_\_ AM / PM  
Rec'd By \_\_\_\_\_  
Fee Rec'd \$ \_\_\_\_\_  
Check No. \_\_\_\_\_  
Refund \_\_\_\_\_ Date \_\_\_\_\_

**1. NAME OF APPLICANT** MONTANA DEPARTMENT OF FISH, WILDLIFE & PARKS

Mailing address 1420 East 6th Avenue; P.O.Box 200701

City Helena State MT Zip 59620

Phone: Home 406-444-2447

Other \_\_\_\_\_ E-mail address \_\_\_\_\_

**2. SOURCE OF WATER SUPPLY**

Well Estimated Depth in Feet \_\_\_\_\_  Developed Spring Name \_\_\_\_\_

Lake Name \_\_\_\_\_ Tributary to \_\_\_\_\_

Stream Name Missouri River Dredge Cut Area

Unnamed Source - Tributary to \_\_\_\_\_

Closed Basin (A closed basin results when water drains into a depression, lake, etc. from which water escapes only by evaporation.)

Other \_\_\_\_\_

**3. POINT OF DIVERSION** (Describe the location to the nearest 10 acres)

(1) \_\_\_\_\_ 1/4 \_\_\_\_\_ 1/4 NE 1/4 Section 8 Township 26 N/S Range 41 EW Valley County

Lot \_\_\_\_\_ Block \_\_\_\_\_ Tract No. \_\_\_\_\_ Subdivision Name \_\_\_\_\_

Government Lot \_\_\_\_\_

(2) \_\_\_\_\_ 1/4 \_\_\_\_\_ 1/4 \_\_\_\_\_ 1/4 Section \_\_\_\_\_ Township \_\_\_\_\_ N/S Range \_\_\_\_\_ EW \_\_\_\_\_ County

Lot \_\_\_\_\_ Block \_\_\_\_\_ Tract No. \_\_\_\_\_ Subdivision Name \_\_\_\_\_

Government Lot \_\_\_\_\_

**4. MEANS OF DIVERSION**

Headgate

Pipeline \_\_\_\_\_ Size \_\_\_\_\_

Dam (Complete item 5)

Pit (Complete item 5)

Other Infiltration Gallery/Raw Water Intake

Pump  
3@5500GPM Rated Capacity (GPM or GFS)  
2@ 800  
30-150 Horsepower  
40-80 Lift in Feet TDH

Describe your plans, if any, for measuring your water use: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

5. RESERVOIR Check the boxes that pertain to your development. (See formulas below for computing capacity) N/A - Flow Through Use

- Proposed New Reservoir Capacity \_\_\_\_\_ acre-feet Name (if any) \_\_\_\_\_
- Existing Reservoir Capacity \_\_\_\_\_ acre-feet Name (if any) \_\_\_\_\_
- Enlargement of Existing Reservoir Water Right # \_\_\_\_\_
- Existing Reservoir Capacity \_\_\_\_\_ acre-feet Name (if any) \_\_\_\_\_
- Proposed Enlarged Reservoir Capacity \_\_\_\_\_ acre-feet
- Drainage device will be installed
- Reservoir located on the source  Reservoir located away from the source

Location of impoundment structure (dam or pit):

\_\_\_\_\_ 1/4 \_\_\_\_\_ 1/4 \_\_\_\_\_ 1/4 Section \_\_\_\_\_ TWP \_\_\_\_\_ N/S RGE \_\_\_\_\_ E/W \_\_\_\_\_ County

PIT: Surface Area \_\_\_\_\_ x Maximum Depth \_\_\_\_\_ x 0.5 = \_\_\_\_\_ Acre-Feet  
Acres Feet Capacity

DAM: Surface Area \_\_\_\_\_ x Maximum Depth \_\_\_\_\_ x 0.4 = \_\_\_\_\_ Acre-Feet  
Acres Feet Capacity

6. PERIOD OF APPROPRIATION (The period during the year when the water will be diverted, impounded, or withdrawn from the source.)

\_\_\_\_\_ 1 Jan. \_\_\_\_\_ to \_\_\_\_\_ 31 Dec. \_\_\_\_\_ Inclusive Each Year  
Month / Day Month / Day

7. PROPOSED BENEFICIAL USE Check the boxes that pertain to your development.

- Domestic: Number of Homes to be Supplied \_\_\_\_\_
- Lawn & Garden: Maximum size in acres \_\_\_\_\_
- Stock: Maximum Number and Type \_\_\_\_\_
- Other: Fish Hatchery
- Irrigation:  Sprinkler - Type \_\_\_\_\_  Contour Ditch  Other \_\_\_\_\_
- Border Dike  Waterspreading/Spreader Dike

Crops to be grown: \_\_\_\_\_

If this water will be used on land already irrigated, indicate the water right numbers applicable to the existing irrigation.

\_\_\_\_\_  
 \_\_\_\_\_

8. PLACE OF USE

County Valley Subdivision Name \_\_\_\_\_

Irrigation / Lawn & Garden New (N) or Supplemental (S)

_____ Acres	Lot _____	Block _____	_____ 1/4	_____ 1/4	_____ 1/4 Section	_____ TWP	_____ N/S	RGE _____	_____ E/W	N-S
_____ Acres	Lot _____	Block _____	_____ 1/4	_____ 1/4	_____ 1/4 Section	_____ TWP	_____ N/S	RGE _____	_____ E/W	N-S
_____ Acres	Lot _____	Block _____	_____ 1/4	_____ 1/4	_____ 1/4 Section	_____ TWP	_____ N/S	RGE _____	_____ E/W	N-S
_____ Acres	Lot _____	Block _____	_____ 1/4	_____ 1/4	_____ 1/4 Section	_____ TWP	_____ N/S	RGE _____	_____ E/W	N-S
_____ Acres	Lot _____	Block _____	_____ 1/4	_____ 1/4	_____ 1/4 Section	_____ TWP	_____ N/S	RGE _____	_____ E/W	N-S
_____ Acres	Lot _____	Block _____	_____ 1/4	_____ 1/4	_____ 1/4 Section	_____ TWP	_____ N/S	RGE _____	_____ E/W	N-S
_____ Acres	Lot _____	Block _____	_____ 1/4	_____ 1/4	_____ 1/4 Section	_____ TWP	_____ N/S	RGE _____	_____ E/W	N-S
_____ Acres	Lot _____	Block _____	_____ 1/4	_____ 1/4	_____ 1/4 Section	_____ TWP	_____ N/S	RGE _____	_____ E/W	N-S

\_\_\_\_\_ TOTAL ACRES

8. (Cont.) Place of Use Non-Irrigation

Purpose of use Fish Propagation - Hatchery Production Place of use same as Point of Diversion, CHECK

1/4 1/4 1/4 Section        TWP        N/S RGE        E/W County       

Lot        Block        Tract No.        Government Lot       

Purpose of use        Place of use same as Point of Diversion, CHECK

1/4 1/4 1/4 Section        TWP        N/S RGE        E/W County       

Lot        Block        Tract No.        Government Lot       

Purpose of use        Place of use same as Point of Diversion, CHECK

1/4 1/4 1/4 Section        TWP        N/S RGE        E/W County       

Lot        Block        Tract No.        Government Lot       

9. FLOW RATE, VOLUME, PURPOSE OF USE, AND PERIOD OF USE

(peak)	<u>11,000</u>	CFS	<u>8872</u>	for	<u>Fish Propagation</u>	from	<u>1 Jan.</u>	to	<u>31 Dec.</u>
(Aug)	<u>5,500</u>	GPM up to	<u>8872</u>		<u>Purpose of Use</u>		<u>Month/Day</u>		<u>Month/Day</u>
			<u>Acre-Feet</u>						
		CFS		for		from		to	
		GPM up to			<u>Purpose of Use</u>		<u>Month/Day</u>		<u>Month/Day</u>
			<u>Acre-Feet</u>						
		CFS		for		from		to	
		GPM up to			<u>Purpose of Use</u>		<u>Month/Day</u>		<u>Month/Day</u>
			<u>Acre-Feet</u>						
		CFS		for		from		to	
		GPM up to			<u>Purpose of Use</u>		<u>Month/Day</u>		<u>Month/Day</u>
			<u>Acre-Feet</u>						
TOTAL AMOUNT REQUESTED			<u>11,000</u>		CFS		<u>8872</u>		ACRE-FEET PER YEAR.
					GPM UP TO				

10. PROPOSED COMPLETION PERIOD

2 How many years will be needed to complete the project and put the water to use after the permit is received?  
Years (NOTE: The water use must not begin until a permit is received.)

11. LOCATION MAP (Must be included)

A map showing the following items must accompany this application. An ASCS aerial photo or USGS topographic map may be used.

a) Section Corners and Numbers      c) Point of Diversion      e) Location of Conveyance Ditch, Pipeline, etc.  
 b) Township and Range Numbers      d) Place of Use (Irrigated Acres, Stock Tanks, etc.)

12. WATER MEASUREMENT

Describe your plans, if any, for measuring water use: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

13. REMARKS (Provide any additional information to explain the proposed appropriation.)

Water consumption is minimal - related only to evaporation from the external bearing ponds. Standard use is in a one - pass mode through the hatchery, to the settling pond, with flow returned to the dredge cut area of the Missouri River.

14. CONTACT PERSON

All communications by the Department concerning the application will be directed through the applicant identified in Section 1 unless a contact person is provided. If a contact person is provided, the contact person will receive all correspondence with a copy sent to the applicant.

- OR
- If the applicant is not an individual (e.g., corporation, estate, trust, agency, ranch), provide the following information:
  - If communications are to be conducted through an individual other than the applicant (e.g., legal counsel, consultant, employee, lessee), provide the following information:

Name of Contact \_\_\_\_\_ Title \_\_\_\_\_

Address \_\_\_\_\_

City/State/Zip \_\_\_\_\_ Phone \_\_\_\_\_

E-mail address \_\_\_\_\_

### 15. AFFIDAVIT

I affirm that statements appearing here are to the best of my knowledge true and correct. I also affirm I have possessory interest, or the written consent of the person with the possessory interest, in the property where the water is to be put to beneficial use and if applicable, exclusive property rights in the groundwater development or the written consent of the person with those rights.

Applicant's Signature \_\_\_\_\_ Date \_\_\_\_\_

\_\_\_\_\_ Date \_\_\_\_\_

Subscribed and sworn before me this \_\_\_\_\_ day of \_\_\_\_\_



Notary's Signature \_\_\_\_\_

Notary for the State of \_\_\_\_\_

Residing at \_\_\_\_\_

My commission expires \_\_\_\_\_

### WATER RESOURCES REGIONAL OFFICES

#### Billings

Airport Industrial Park  
1371 Rimtop Drive  
Billings, MT 59105-1978  
Phone: 406-247-4415  
Fax: 406-247-4416  
Serving: Big Horn, Carbon, Carter  
Custer, Fallon, Powder River, Prairie,  
Rosebud, Stillwater, Sweet Grass,  
Treasure, and Yellowstone Counties

#### Havre

210 6th Avenue  
P.O. Box 1828  
Havre, MT 59501-1828  
Phone: 406-265-5516  
Fax: 406-265-2225  
Serving: Blaine, Chouteau,  
Glacier, Hill, Liberty, Pondera,  
Teton, and Toole Counties

#### Lewistown

613 NE Main Street, Suite E  
Lewistown, MT 59457-2020  
Phone: 406-538-7459  
Fax: 406-538-7089  
Serving: Cascade, Fergus, Golden  
Valley, Judith Basin, Meagher,  
Musselshell, Petroleum, and  
Wheatland Counties

#### Bozeman

151 Evergreen Drive, Suite C  
Bozeman, MT 59715  
Phone: 406-586-3136  
Fax: 406-587-9726  
Serving: Gallatin, Madison, and  
Park Counties

#### Helena

21 North Last Chance Gulch  
P.O. Box 201601  
Helena, MT 59620-1601  
Phone: 406-449-0944  
Fax: 406-442-9315  
Serving: Beaverhead, Broadwater,  
Deer Lodge, Jefferson, Lewis and  
Clark, Powell, and Silver Bow Counties

#### Missoula

Town and Country Shopping Center  
1610 South 3rd Street West, Suite 103  
P.O. Box 5004  
Missoula, MT 59806-5004  
Phone: 406-721-4284  
Fax: 406-542-1496  
Serving: Granite, Mineral,  
Missoula, and Ravalli Counties

#### Glasgow

222 6th Street South  
P.O. Box 1269  
Glasgow, MT 59230-1269  
Phone: 406-228-2561  
Fax: 406-228-8706  
Serving: Daniels, Dawson, Garfield,  
McCone, Phillips, Richland,  
Roosevelt, Sheridan, Valley, and  
Wibaux Counties

#### Kalispell

109 Cooperative Way, Suite 110  
Kalispell, MT 59901-2387  
Phone: 406-752-2288  
Fax: 406-752-2843  
Serving: Flathead, Lake, Lincoln,  
and Sanders Counties

For Mailing, Use Post Office Box Number.

**MONTANA DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION**

**48 N. LAST CHANCE GULCH P.O. BOX 201601 HELENA, MT 59620-1601 444-6610**

**WEBSITE <http://www.dnrc.mt.state.us/wrd/home.htm>**



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SECTION 01356

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11/01

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## SECTION 01356

STORM WATER POLLUTION PREVENTION MEASURES  
11/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 448 (1998) Sizes of Aggregate for Road and Bridge Construction

ASTM D 4873 (2001) Identification, Storage, and Handling of Geosynthetic Rolls and Samples

## AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 288 (2000) Geotextile for Highway Applications

## 1.2 GENERAL

The Contractor shall implement the storm water pollution prevention measures specified in this section in a manner which will meet the requirements of Section 01355 ENVIRONMENTAL PROTECTION, and the requirements of the Montana Pollution Discharge Elimination System (MPDES) permit specified in Section 01569 MONTANA MPDES PERMIT REQUIREMENTS FOR STORM WATER DISCHARGES FROM CONSTRUCTION SITES.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-07 Certificates

Mill Certificate or Affidavit

## 1.4 EROSION AND SEDIMENT CONTROLS

The controls and measures required by the Contractor are described in the Storm Water Pollution Prevention Plan (SWPPP) attached to Section 01569 MONTANA MPDES PERMIT REQUIREMENTS FOR STORM WATER DISCHARGES FROM CONSTRUCTION SITES and shown on the drawings.

## PART 2 PRODUCTS

## 2.1 COMPONENTS FOR SILT FENCES

### 2.1.1 Geotextile

The geotextile shall comply with the requirements of AASHTO M 288 for temporary silt fence.

### 2.1.2 Silt Fence Stakes and Posts

The Contractor may use either wooden stakes or steel posts for fence construction. Wooden stakes utilized for silt fence construction, shall have a minimum cross section of 2 inches by 2 inches when oak is used and 4 inches by 4 inches when pine is used, and shall have a minimum length of 3 feet. Steel posts (standard "U" or "T" section) utilized for silt fence construction, shall have a minimum weight of 1.33 pounds per linear foot and a minimum length of 5 feet.

### 2.1.3 Mill Certificate or Affidavit

A mill certificate or affidavit shall be provided attesting that the geotextile and factory seams meet chemical, physical, and manufacturing requirements specified above. The mill certificate or affidavit shall specify the actual Minimum Average Roll Values and shall identify the fabric supplied by roll identification numbers. The Contractor shall submit a mill certificate or affidavit signed by a legally authorized official from the company manufacturing the geotextile.

### 2.1.4 Identification Storage and Handling

Geotextile shall be identified, stored and handled in accordance with ASTM D 4873.

### 2.1.5 Support Mesh

Support mesh shall be 14-1/2 gage or heavier steel wire with a mesh spacing of 6 by 6 inch or a prefabricated polymeric mesh of equivalent strength.

## 2.2 Erosion Control Blankets

Erosion control blankets shall be a machine-produced mat with a biodegradable agricultural straw matrix (approximately 0.50 lb/sq yd) and photodegradable netting on each side. The blanket shall be sewn together with degradable thread. Installation staple patterns shall be clearly marked on the erosion control blanket with environmentally safe paint.

## 2.3 STONE CONSTRUCTION ENTRANCE

Aggregate for construction entrance shall conform to ASTM D 448, Size 1. Minor variations from the gradation specified will be permitted. Geotextile shall conform to paragraph GEOTEXTILES.

## 2.4 GEOTEXTILES

Geotextile for other than silt fence shall comply with the requirements of AASHTO M 288 for a separation geotextile.

## PART 3 EXECUTION

### 3.1 INSTALLATION OF SILT FENCES

Silt fences shall extend a minimum of 16 inches above the ground surface and shall not exceed 34 inches above the ground surface. Filter fabric shall be from a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are unavoidable, filter fabric shall be spliced together at a support post, with a minimum 6 inch overlap, and securely sealed. A trench shall be excavated approximately 6 inches wide and 8 inches deep on the upslope side of the location of the silt fence. The 6-inch by 8-inch trench shall be backfilled and the soil compacted over the filter fabric. Silt fences shall be removed upon approval by the Contracting Officer.

### 3.2 Stone Construction Entrance

The area of the entrance shall be cleared of all vegetation, roots, and other objectionable material. The aggregate layer shall have a minimum total thickness of 6 inches. A geotextile shall be placed beneath aggregate for the full width and length of the entrance. A minimum of 3 inches of the aggregate shall be placed in a cut section to provide stability and secure the geotextile. If conditions on the site are such that the majority of the mud is not removed by the vehicles traveling over the stone, then the tires of the vehicles shall be washed before entering the road. Wash water must be carried away from the entrance to an approved settling area to remove sediment. A wash rack may also be installed for washing of vehicles.

### 3.3 MAINTENANCE

The Contractor shall maintain the temporary and permanent vegetation, erosion and sediment control measures, and other protective measures in good and effective operating condition by performing routine inspections to determine condition and effectiveness, by restoration of destroyed vegetative cover, and by repair of erosion and sediment control measures and other protective measures. The following procedures shall be followed to maintain the protective measures.

#### 3.3.1 Silt Fences

Silt fences shall be inspected in accordance with paragraph INSPECTIONS. Any required repairs shall be made promptly. Close attention shall be paid to the repair of damaged silt fence resulting from end runs and undercutting. Should the fabric on a silt fence decompose or become ineffective, and the barrier is still necessary, the fabric shall be replaced promptly. Sediment deposits shall be removed when deposits reach one-third of the height of the barrier. When a silt fence is no longer required, it shall be removed. The immediate area occupied by the fence and any sediment deposits shall be shaped to an acceptable grade. The areas disturbed by this shaping shall be seeded in accordance with Section 02921 SEEDING.

#### 3.3.2 Storm Drain Inlet Protection

Inlet protection structures shall be inspected after each rainfall and repairs made as needed. Sediment shall be removed and the trap restored to its original dimensions when the sediment has accumulated to one half the design depth.

#### 3.3.3 Stone Construction Entrance

Stone construction entrances shall be maintained in a condition which will prevent tracking or flow of mud onto paved roads. This may require periodic top dressing with additional stone or the washing and reworking of existing stone as conditions demand and repair and/or cleanout of any structures used to trap sediment. The use of water trucks to remove materials dropped, washed, or tracked onto roadways will not be permitted under any circumstances.

#### 3.4 INSPECTIONS

##### 3.4.1 General

Inspection of protective measures shall conform to the requirements in the Erosion Control Plan.

-- End of Section --

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SECTION 01400

SPECIAL SAFETY REQUIREMENTS

05/00 Rev 12/01

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## SECTION 01400

SPECIAL SAFETY REQUIREMENTS  
05/00 Rev 12/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1926 Safety and Health Regulations for Construction

## ENGINEERING MANUALS (EM)

EM 385-1-1 (1996 and Changes) Safety and Health Requirements Manual

## 1.2 SUMMARY

## 1.2.1 General

This section provides guidelines for preparation of accident prevention plans, and to implement the accident prevention clause (this specification) and EM 385-1-1, Safety and Health Requirements Manual. The U.S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1 is available from U.S. Government bookstores operated by the Government Printing Office and a copy is included on the CD-ROM issued with this solicitation. Changes to EM 385-1-1 applicable to this contract include only those revisions posted at the following website (all revisions up to the time this solicitation is issued):

[http://www.hq.usace.army.mil/soh/hqusace\\_soh.htm](http://www.hq.usace.army.mil/soh/hqusace_soh.htm) ("Changes to EM"). U.S. Government bookstores are located in most major cities including Milwaukee, Chicago, Kansas City, Denver, and Pueblo, Colorado.

## 1.3 PRECONSTRUCTION CONFERENCE

See Contract Clause "PRECONSTRUCTION CONFERENCE". A preconstruction conference will be scheduled prior to beginning of site work. Requirements relative to planning and administration of the overall safety program will be discussed.

## 1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

## Accident Prevention Plan; G-AO

The written site-specific Accident Prevention Plan.

## SD-07 Certificates

## Qualifications; G-AO.

A written report providing evidence of qualifications for personnel, facilities and equipment assigned to the work.

## 1.5 ACCIDENT PREVENTION PLAN

The Contractor shall submit, prior to the start of on site construction activity, a proposed accident prevention plan which shall be the accident prevention policy to be followed by all of the Contractor's and subcontractor's personnel and supervisory staff during performance of the work.

## 1.5.1 Requirements

The proposed plan shall be developed after a careful analysis of the work involved and shall be tailored specifically to the conditions of this project. The Contractor's accident prevention plan shall contain, as a minimum, the following general information or procedures for the activity indicated. The Contractor shall submit his plan for review and acceptance prior to commencing work.

## 1.5.1.1 Responsible Individual(s)

The Contractor shall designate an onsite employee as the individual responsible for insuring the accident prevention plan is implemented and enforced.

## 1.5.1.2 Subcontractor Supervision

Explain procedures to assure that subcontractor(s) fully comply with the accident prevention plan.

## 1.5.1.3 Indoctrination of New Employees

The plan shall include provisions for advising workers of the purpose of the accident prevention plan, specific hazards on the job and precautions to be taken, emergency procedures, information concerning tool box safety meetings, required protective equipment, cleanup rules and location of company safety rules (posting or handout).

## 1.5.1.4 Tool Box Safety Meetings

Hold weekly "Tool Box" safety meetings. Timely safety subjects shall be determined by a responsible individual. Employees will be informed of time, location, who will conduct, and subject. Identify procedures for including subcontractors. The Contractor shall provide a copy of the Weekly Tool Box Meeting and Monthly Supervisor's Safety Meeting to the Contracting Officer.

## 1.5.1.5 Fire Prevention and Protection

Identify source of fire protection. Insure adequate fire extinguishers, water barrels, or other fire-fighting equipment is located on site. Explain prevention activities to include storage areas and special hazards such as welding and use of flammable liquids, and other special hazards.

#### 1.5.1.6 Housekeeping

Daily cleanup of all debris and waste materials is required. Adequate disposal containers should be placed strategically around the site. Debris shall be removed on a regular basis. Explain procedures that include use of barrels, dumpsters, trash chutes, etc.

#### 1.5.1.7 Mechanical Equipment Inspection

All mechanical equipment (trucks, cranes, forklifts, backhoes, graders, etc.) shall be inspected prior to use and at fixed intervals throughout the life of the contract. Explain how inspections will be accomplished (frequency, by whom, and records to be kept).

#### 1.5.1.8 First Aid and Medical Facilities

First aid facilities shall be made available on the job site. Arrangements for emergency medical attention shall be made prior to start of work. All emergency numbers (doctor, hospital, ambulance, fire department) shall be posted at the project superintendent's office.

#### 1.5.1.9 Sanitation

Include provisions for toilet facilities, drinking water and washing facilities. A sufficient number of toilet facilities as specified in EM 385-1-1 shall be provided unless permission is granted to use existing facilities (portable chemical are authorized). Insure safe drinking water and individual cups are available. For the projects where corrosive or toxic materials are used, separate washing facilities are required.

#### 1.5.1.10 Safety Promotions

The Contractor shall promote accident prevention. Identify method (posters, awards etc.).

#### 1.5.1.11 Accident Reporting

All accidents (employee injuries, vehicle, building, or equipment damage etc.) regardless of their severity, shall be reported to the onsite government representative or to the area engineer, who in turn will advise the Contractor of forms to be submitted and timeframes.

#### 1.5.1.12 Job Hazard Analysis

When job situations change and it is necessary to alter safety requirements, a Job Hazard Analysis will be accomplished, documented, and added as an addendum to the Accident Prevention Plan. Each Job Hazard Analysis shall include, but not be limited to, a description of the work, probable hazards related to that work and positive precautionary measures to be taken to reduce or eliminate each hazard. An example of changing situations may be new subcontractors performing work such as earth moving, trenching, concrete work, roofing, electrical, masonry etc. The onsite government representative will determine the format and amount of detail required of the written plan.

1.6 EXCAVATION AND TRENCHING

The standards for excavation and trenching are outlined in 29 CFR 1926, Subpart P. These standards shall be followed in addition to those outlined in EM 385-1-1.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

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SECTION 01451A

CONTRACTOR QUALITY CONTROL

**10/02; Omaha Revision 11/02**

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## SECTION 01451A

CONTRACTOR QUALITY CONTROL  
10/02; Omaha Revision 11/02

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 3740	(2001) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E 329	(2000b) Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

## 1.2 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program, and all costs associated therewith shall be included in the applicable unit prices or lump-sum prices contained in the Bidding Schedule.

## PART 2 PRODUCTS (Not Applicable)

## PART 3 EXECUTION

## 3.1 GENERAL REQUIREMENTS

The Contractor is responsible for quality control and shall establish and maintain an effective quality control system in compliance with the Contract Clause titled "Inspection of Construction." The quality control system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. The system shall cover all construction operations, both onsite and offsite, and shall be keyed to the proposed construction sequence. The site project superintendent will be held responsible for the quality of work on the job and is subject to removal by the Contracting Officer for non-compliance with the quality requirements specified in the contract. The site project superintendent in this context shall be the highest level manager responsible for the overall construction activities at the site, including quality and production. The site project superintendent shall maintain a physical presence at the site at all times, except as otherwise acceptable to the Contracting Officer, and shall be responsible for all construction and construction related activities at the site.

## 3.2 QUALITY CONTROL PLAN

The Contractor shall furnish for review by the Government, not later than 10 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract Clause titled "Inspection of Construction." The plan shall identify personnel, procedures, control, instructions, tests, records, and forms to be used. The Government will consider an interim plan for the first 30 days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the features of work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started.

### 3.2.1 Content of the CQC Plan

The CQC Plan shall include, as a minimum, the following to cover all construction operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents:

- a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. The staff shall include a CQC System Manager who shall report to the project superintendent.
- b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.
- c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Copies of these letters shall also be furnished to the Government.
- d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with Section 01330 SUBMITTAL PROCEDURES.
- e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities approved by the Contracting Officer shall be used.)
- f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.
- g. Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures shall establish verification that identified

deficiencies have been corrected.

- h. Reporting procedures, including proposed reporting formats.
- i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks, has separate control requirements, and may be identified by different trades or disciplines, or it may be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section. This list will be agreed upon during the coordination meeting.

### 3.2.2 Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in his CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

### 3.2.3 Notification of Changes

After acceptance of the CQC Plan, the Contractor shall notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

## 3.3 QA/QC PRECONSTRUCTION COORDINATION MEETING

After the Preconstruction Conference, and before the start of construction, and prior to acceptance by the Government of the CQC Plan, the Contractor shall meet with the Contracting Officer or Authorized Representative and discuss the Contractor's quality control system. The CQC Plan shall be submitted for review a minimum of 10 calendar days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting shall be prepared by the Government and signed by both the Contractor and the Contracting Officer. The minutes shall become a part of the contract file. There may be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

## 3.4 QUALITY CONTROL ORGANIZATION

### 3.4.1 Personnel Requirements

The requirements for the CQC organization are a CQC System Manager and sufficient number of additional qualified personnel to ensure safety and contract compliance. The Safety and Health Manager shall receive direction and authority from the CQC System Manager and shall serve as a member of the CQC staff. Personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly will also be included as part of the CQC organization. The

Contractor's CQC staff shall maintain a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure contract compliance. The CQC staff shall be subject to acceptance by the Contracting Officer. The Contractor shall provide adequate office space, filing systems and other resources as necessary to maintain an effective and fully functional CQC organization. Complete records of all letters, material submittals, show drawing submittals, schedules and all other project documentation shall be promptly furnished to the CQC organization by the Contractor. The CQC organization shall be responsible to maintain these documents and records at the site at all times, except as otherwise acceptable to the Contracting Officer.

3.4.2 CQC System Manager

The Contractor shall identify as CQC System Manager an individual within the onsite work organization who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. The CQC System Manager shall be either a graduate engineer, graduate architect, or a graduate of construction management, with a minimum of 2 years construction experience on construction similar to this contract or a construction person with a minimum of 5 years in related work.

This CQC System Manager shall be on the site at all times during construction and shall be employed by the prime Contractor. The CQC System Manager shall be assigned no other duties . An alternate for the CQC System Manager shall be identified in the plan to serve in the event of the System Manager's absence. The requirements for the alternate shall be the same as for the designated CQC System Manager.

3.4.3 CQC Personnel

In addition to CQC personnel specified elsewhere in the contract, the Contractor shall provide as part of the CQC organization specialized personnel to assist the CQC System Manager for the following areas: electrical, mechanical, . These individuals shall be directly employed by the prime Contractor and may not be employed by a supplier or sub-contractor on this project ; be responsible to the CQC System Manager; be physically present at the construction site during work on their areas of responsibility; have the necessary education and/or experience in accordance with the experience matrix listed herein. These individuals shall have no other duties other than quality control .

Experience Matrix

Area	Qualifications
a. Mechanical	Graduate Mechanical Engineer with 2 yrs experience or person with 5 yrs related experience
b. Electrical	Graduate Electrical Engineer with 2 yrs related experience or person with 5 yrs related experience

## Experience Matrix

Area	Qualifications	
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## 3.4.4 Additional Requirement

In addition to the above experience and education requirements the CQC System Manager shall have completed the course entitled "Construction Quality Management For Contractors". This course is periodically offered at each of the four area offices in the Omaha District according to the following revolving training schedule:.

<u>Badger Area</u>	First Session	Between 15 & 25 April
	Second Session	Between 15 & 25 October
Point of Contact	Roy Brewer	(319) 753-1386
<u>Black Hills Area</u>	First Session	Between 1 & 10 March
	Second Session	Between 1 & 10 September
Point of Contact	Dwight Pochant	(605) 923-2983
<u>Fort Crook Area</u>	First Session	Between 15 & 25 January
	Second Session	Between 15 & 25 July
Point of Contact	Al Kreisler	(402) 293-2540
<u>Rocky Mountain</u>	First Session	Between 1 & 10 June
	Second Session	Between 1 & 10 December
Point of Contact	Paul Jendzejec	(719) 556-4184

The exact date and location for the sessions will be determined approximately 30 days in advance of the training. The cost of training is presently established at \$50 to be paid by each student in advance of the training. For information about a particular session, the best source is the point of contact listed above.

## 3.4.5 Organizational Changes

The Contractor shall maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, the Contractor shall revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

## 3.5 SUBMITTALS AND DELIVERABLES

Submittals, if needed, shall be made as specified in Section 01330 SUBMITTAL PROCEDURES. The CQC organization shall be responsible for certifying that all submittals and deliverables are in compliance with the contract requirements. When Section 15950A HEATING, VENTILATING AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS; 15951A DIRECT DIGITAL CONTROL FOR HVAC; 15990A TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS; or 15995A COMMISSIONING OF HVAC SYSTEMS are included in the contract, the submittals required by those sections shall be coordinated with Section 01330 SUBMITTAL PROCEDURES to ensure adequate time is allowed for each type of submittal required.

## 3.6 CONTROL

Contractor Quality Control is the means by which the Contractor ensures

that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control shall be conducted by the CQC System Manager for each definable feature of the construction work as follows:

### 3.6.1 Preparatory Phase

This phase shall be performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase shall include:

- a. A review of each paragraph of applicable specifications, reference codes, and standards. A copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field shall be made available by the Contractor at the preparatory inspection. These copies shall be maintained in the field and available for use by Government personnel until final acceptance of the work.
- b. A review of the contract drawings.
- c. A check to assure that all materials and/or equipment have been tested, submitted, and approved.
- d. Review of provisions that have been made to provide required control inspection and testing.
- e. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.
- f. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.
- g. A review of the appropriate activity hazard analysis to assure safety requirements are met.
- h. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.
- i. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.
- j. Discussion of the initial control phase.
- k. The Government shall be notified at least 48 hours in advance of beginning the preparatory control phase. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The results of the preparatory phase actions shall be documented by separate minutes prepared by the CQC System Manager and attached to the daily CQC report. The Contractor shall instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

### 3.6.2 Initial Phase

This phase shall be accomplished at the beginning of a definable feature of work. The following shall be accomplished:

- a. A check of work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.
- b. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing.
- c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.
- d. Resolve all differences.
- e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
- f. The Government shall be notified at least 48 hours in advance of beginning the initial phase. Separate minutes of this phase shall be prepared by the CQC System Manager and attached to the daily CQC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.
- g. The initial phase should be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

### 3.6.3 Follow-up Phase

Daily checks shall be performed to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Final follow-up checks shall be conducted and all deficiencies corrected prior to the start of additional features of work which may be affected by the deficient work. The Contractor shall not build upon nor conceal non-conforming work.

### 3.6.4 Additional Preparatory and Initial Phases

Additional preparatory and initial phases shall be conducted on the same definable features of work if: the quality of on-going work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity; or if other problems develop.

## 3.7 TESTS

### 3.7.1 Testing Procedure

The Contractor shall perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, the Contractor shall furnish to the Government duplicate samples of test specimens for possible testing by the

Government. Testing includes operation and/or acceptance tests when specified. The Contractor shall procure the services of a Corps of Engineers approved testing laboratory or establish an approved testing laboratory at the project site. The Contractor shall perform the following activities and record and provide the following data:

- a. Verify that testing procedures comply with contract requirements.
- b. Verify that facilities and testing equipment are available and comply with testing standards.
- c. Check test instrument calibration data against certified standards.
- d. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
- e. Results of all tests taken, both passing and failing tests, shall be recorded on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test shall be given. If approved by the Contracting Officer, actual test reports may be submitted later with a reference to the test number and date taken. An information copy of tests performed by an offsite or commercial test facility shall be provided directly to the Contracting Officer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

### 3.7.2 Testing Laboratories

#### 3.7.2.1 Capability Check

The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel shall meet criteria detailed in ASTM D 3740 and ASTM E 329.

#### 3.7.2.2 Capability Recheck

If the selected laboratory fails the capability check, the Contractor will be assessed the actual cost for the recheck to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the contract amount due the Contractor.

### 3.7.3 Onsite Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests, and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

### 3.7.4 Furnishing or Transportation of Samples for Testing

Costs incidental to the transportation of samples or materials shall be borne by the Contractor. Samples of materials for test verification and

acceptance testing by the Government shall be delivered to the Resident or Area (as directed) Office.

For delivery by mail: Commander and Director  
U.S. Army Engineer Waterways Experiment Station  
Attn: CEWES-GS  
3909 Hallsferry Road  
Vicksburg, Mississippi 39180-6199

For other deliveries: Commander and Director  
U.S. Army Engineer Waterways Experiment Station  
Attn: CEWES-GS  
3909 Hallsferry Road  
Vicksburg, Mississippi 39180-6199

Coordination for each specific test, exact delivery location, and dates will be made through the Resident or Area (as directed) Office.

### 3.8 COMPLETION INSPECTION

#### 3.8.1 Punch-Out Inspection

Near the end of the work, or any increment of the work established by a time stated in the Special Clause, "Commencement, Prosecution, and Completion of Work", or by the specifications, the CQC Manager shall conduct an inspection of the work. A punch list of items which do not conform to the approved drawings and specifications shall be prepared and included in the CQC documentation, as required by paragraph DOCUMENTATION. The list of deficiencies shall include the estimated date by which the deficiencies will be corrected. The CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected. Once this is accomplished, the Contractor shall notify the Government that the facility is ready for the Government Pre-Final inspection.

#### 3.8.2 Pre-Final Inspection

The Government will perform the pre-final inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. The Contractor's CQC System Manager shall ensure that all items on this list have been corrected before notifying the Government, so that a Final inspection with the customer can be scheduled. Any items noted on the Pre-Final inspection shall be corrected in a timely manner. These inspections and any deficiency corrections required by this paragraph shall be accomplished within the time slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate completion dates.

#### 3.8.3 Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Representative shall be in attendance at the final acceptance inspection. Additional Government personnel including, but not limited to, those from Base/Post Civil Facility Engineer user groups, and major commands may also be in attendance. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon results of the Pre-Final inspection. Notice shall be given to the Contracting Officer at

least 14 days prior to the final acceptance inspection and shall include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the contract clause titled "Inspection of Construction".

### 3.9 DOCUMENTATION

The Contractor shall maintain current records providing factual evidence that required quality control activities and/or tests have been performed. These records shall include the work of subcontractors and suppliers and shall be on an acceptable form that includes, as a minimum, the following information:

- a. Contractor/subcontractor and their area of responsibility.
- b. Operating plant/equipment with hours worked, idle, or down for repair.
- c. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.
- d. Test and/or control activities performed with results and references to specifications/drawings requirements. The control phase shall be identified (Preparatory, Initial, Follow-up). List of deficiencies noted, along with corrective action.
- e. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.
- f. Submittals and deliverables reviewed, with contract reference, by whom, and action taken.
- g. Offsite surveillance activities, including actions taken.
- h. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
- i. Instructions given/received and conflicts in plans and/or specifications.
- j. Contractor's verification statement.

These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. The original and one copy of these records in report form shall be furnished to the Contracting Officer's Representative on the first day following the date(s) covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, one report shall be prepared and submitted for every 7 days of no work and on

the last day of a no work period. All calendar days shall be accounted for throughout the life of the contract. The first report following a day of no work shall be for that day only. Reports shall be signed and dated by the CQC System Manager. The report from the CQC System Manager shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel.

### 3.10 SAMPLE FORMS

Sample forms enclosed at the end of this section.

### 3.11 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.





7. Submittals Reviewed:

(a) Submittal No.	(b) Spec/Plan Reference	(c) By Whom	(d) Action
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

8. Offsite Surveillance Activities, Including Action Taken:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

9. Job Safety: (List items checked, results, instructions and corrective actions taken).

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

10. Remarks: (Instructions received or given. Conflict(s) in Plans and/or specifications. Delays encountered.).

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Contractor's Verification: On behalf of the Contractor, I certify this report is complete and correct, and all materials and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications, to the best of my knowledge, except as may be noted above.

\_\_\_\_\_  
CQC System Manager

\_\_\_\_\_  
Date

-- End of Section --

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DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01569

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03/03

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## SECTION 01569

MONTANA MPDES PERMIT REQUIREMENTS  
FOR STORM WATER DISCHARGES  
FROM CONSTRUCTION SITES  
03/03

Attachments: General Permit For Storm Water Discharges Associated  
With Construction Activities  
Notice of Intent  
Storm Water Pollution Prevention Plan  
Notice of Termination  
Site Inspection Report Form

## PART 1 GENERAL

1.1 REFERENCES (Not Applicable)

1.2 SUBMITTALS (Not Applicable)

PART 2 PRODUCTS (Not Applicable)

## PART 3 EXECUTION

## 3.1 GENERAL

The Contractor shall be responsible for implementing the terms and requirements of the attached General Permit For Storm Water Discharges Associated With Construction Activity (Permit No. MTR100000). The Government and the Contractor shall be considered co-permittees. The Government has operational control over construction plans and specifications, including the ability to make modifications to those plans and specifications. The Contractor shall have day-to-day operational control of those activities which are necessary to ensure compliance with the requirements specified herein. The Contractor shall be responsible for all submissions to the Montana Department of Environmental Quality and shall retain the official copy of all documents pertaining to compliance with the permit during construction. The Contractor shall provide the Government a copy of all submissions to the State. All submissions to the State shall be by certified mail. Copies of the return receipt for each submission shall be included with the submittal to the Contracting Officer's Representative. The Contractor shall be responsible for payment of all fees to the State.

## 3.2 IMPLEMENTATION

## 3.2.1 Notice of Intent

The Contractor shall complete and sign the Notice of Intent (NOI) in accordance with MPDES Permit No. MTR100000. The NOI shall be furnished to the Contracting Officer within 10 calendar days of Notice of Award. The Government shall sign and return the NOI within 14 days after receipt by the Contracting Officer. The Contractor shall submit the NOI to the State. The Contractor shall not submit the NOI to the State until the Storm Water

Pollution Prevention Plan (SWPPP) has been accepted and signed by the Government. The Contractor may not begin land disturbance activities until a NOI package receipt confirmation letter has been received from the State.

### 3.2.2 Storm Water Pollution Prevention Plan

#### 3.2.2.1 General

The Contractor shall review the attached SWPPP. Within 10 calendar days of Notice of Award, the Contractor shall complete those portions of the plan which have not been completed by the Government and furnish the updated SWPPP to the Contracting Officer for review and acceptance. The Government shall sign and return the SWPPP within 14 days after receipt by the Contracting Officer. The Contractor shall include appropriate controls and measures for any off-site support activities covered under Part I.B.2 of the permit. The SWPPP shall describe the nature and location of the off-site activity and a location map and site map shall be included in accordance with the permit. Off-site support activities (concrete or asphalt batch plants, equipment staging yards, material storage areas, borrow and waste areas, etc.) must only be included in the plan if they are not commercial operations serving multiple unrelated construction projects.

The Contractor shall be responsible for completing the SWPPP site map. The Contractor shall be responsible for implementing, maintaining and updating the SWPPP (including maps or drawings) during construction. Unless otherwise indicated, the Contractor shall be responsible for implementing all measures described in the SWPPP. The Contractor shall keep the official plan at the site. The SWPPP shall be signed by the Government and the Contractor and submitted with the NOI. If major changes to the SWPPP are required during construction, the SWPPP shall be recertified by the Government and the Contractor.

#### 3.2.2.2 Acceptance of SWPPP

Acceptance of the SWPPP is required prior to submission to the State and start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes to the SWPPP if the Contracting Officer determines that environmental protection requirements are not being met.

#### 3.2.2.3 Notification of Changes

After acceptance of the SWPPP, the Contractor shall notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

#### 3.2.3 Monitoring, Recording and Reporting

The Contractor shall be responsible for all monitoring, recording and reporting specified in the general permit. Copies of all inspection records shall be furnished to the Contracting Officer no more than 2 days after each inspection. The Contractor shall notify the Contracting Officer within 24 hours if an inspection identifies any incidents of non-compliance with the SWPPP and the general permit.

#### 3.2.4 Maintenance

The Contractor shall be responsible for maintaining all erosion and sediment control measures and other protective measures identified in the

SWPPP in an effective operating condition. The Government reserves the right to require the Contractor to perform maintenance on erosion and sediment control measures and other protective measures if the Contracting Officer determines that environmental protection requirements are not being met.

### 3.2.5 Notice of Termination

The Contractor shall notify the Contracting Officer when final stabilization on all portions of the site has been achieved in accordance with Part V.T.6 of the permit. The Contractor shall complete and sign a Notice of Termination (NOT) in accordance with MPDES Permit No. MTR100000. The Contractor's NOT shall be furnished to the Contracting Officer within 5 calendar days after final stabilization (as defined in the permit) has been achieved on all portions of the site. The Government shall sign and return the NOT to the Contractor within 14 calendar days. The Contractor shall submit the NOT to the State.

### 3.2.6 Records Retention

The Government shall be responsible for retaining copies of all records and information resulting from the monitoring activities in accordance with Part III.C.3 of the general permit.

### 3.2.7 Continuation of Expired Permit

If the current MPDES general permit expires prior to completion of construction, the Contractor shall comply with the conditions of the new permit.

-- End of Section --

**MONTANA DEPARTMENT  
OF ENVIRONMENTAL QUALITY**

**AUTHORIZATION TO DISCHARGE UNDER  
THE MONTANA POLLUTANT DISCHARGE ELIMINATION SYSTEM**

**GENERAL PERMIT  
FOR STORM WATER DISCHARGES ASSOCIATED  
WITH CONSTRUCTION ACTIVITY**

In compliance with Montana Code Annotated (MCA) 75-5-101 *et seq.*, the Administrative Rules of Montana (ARM) 17.30.1301 *et seq.*, and ARM 17.30.601 *et seq.*, operators who submit a complete Notice of Intent package for a storm water discharge associated with construction activity under this General Permit for Storm Water Discharges Associated with Construction Activity are authorized to discharge storm water from construction activities to surface waters in accordance with the conditions set forth in Parts I, II, III, IV, and V of this General Permit.

This General Permit shall become effective June 8, 2002.

This General Permit shall expire at midnight, December 31, 2006.

FOR THE MONTANA DEPARTMENT  
OF ENVIRONMENTAL QUALITY

\_\_\_\_\_  
Thomas D. Reid, Supervisor  
Water Quality Discharge Permit Section  
Water Protection Bureau  
Permitting and Compliance Division

Dated this \_\_\_\_\_ day of \_\_\_\_\_, 2002

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## **PREAMBLE**

The purpose of this Preamble is to provide the operators who submit a Notice of Intent package for a storm water discharge associated with construction activity under the General Permit for Storm Water Discharges Associated with Construction Activity a summary of the requirements for compliance with this General Permit.

The basic principle of the General Permit is to identify areas or activities that may contribute pollutants to surface waters and to consider practical methods to reduce such pollutants from your operation. The degree of pollution control necessary will vary depending on the site and the situation. For example, if you are constructing a road on perfectly flat ground where there are no surface waters in close proximity to your activities, the potential to cause pollution of surface waters is minimal, and only minimal erosion and sediment controls would be expected. On the other hand, if you are constructing a highway and there are several stream drainages, etc. in close proximity to your project, very comprehensive and complete pollution controls would be expected.

The major pollutant that could be a potential problem for construction sites will be sediment discharges from increased erosion. If the project will impact a waterbody, you must ensure that minimal sediment reaches surface waters by using appropriate erosion and sediment control measures. The discharge of turbid water may cause a violation of this General Permit. Adequate erosion and sediment control measures must also be used to prevent sediment discharges to riparian areas and ephemeral streams.

Other pollutants likely to be a problem at construction sites are fuels, lubricating oils, construction materials, fertilizers, and pesticides. Managing these materials properly (such as keeping them as far away as possible from surface waters or preventing spills of these materials) is a primary factor in ensuring pollutants do not reach surface waters through storm water runoff.

In order to help characterize the construction activity, potential sources of pollutants, and Best Management Practices (BMPs) to help ensure pollutants do not reach surface waters, operators are required to develop and implement a Storm Water Pollution Prevention Plan (SWPPP). The basic requirements of the SWPPP are provided in Part IV. of this General Permit.

**PART I. COVERAGE UNDER THIS GENERAL PERMIT**

**A. General Permit Area**

The General Permit applies to all areas of the State of Montana.

**B. Sources Covered Under this General Permit**

This General Permit covers all projects or activities which meet the definition of "storm water discharge associated with construction activity" as defined in Part V.T.15. of this General Permit. For determining whether coverage under this General Permit is required, the total land area of disturbance that is part of a larger common plan of development or sale must be used. Determination of the acreage of disturbance does not typically include disturbance for routine maintenance activities on existing roads where the line and grade of the road is not being altered, nor does it include the paving of existing roads.

The General Permit may also cover storm water discharges from support activities related to a construction site (e.g. concrete or asphalt batch plants, equipment staging yards, material storage areas, etc.). This is provided that:

1. The support activity is not a commercial operation serving multiple unrelated construction projects and does not operate beyond the completion of the construction activity.
2. Appropriate controls and measures are identified in the Storm Water Pollution Prevention Plan (SWPPP) for the discharge from the support activity.

All discharges must be in accordance with the submitted SWPPP and the provisions of this General Permit. Any other direct discharge and/or wastewater discharge to surface waters is prohibited unless covered by another MPDES permit.

This General Permit does not relieve the operator(s) from responsibility for compliance with any other applicable federal, state, or local law, rule, standard, ordinance, order, judgment, or decree.

Permittees who have an active permit authorization under the 1997-2002 General Discharge Permit for Storm Water Associated with Construction Activity (issued prior to the effective date of this 2002-2006 General Permit) shall refer to Part I.C.5. of this reissued General Permit for requirements on continued General Permit coverage for their storm water discharge associated with construction activity.

**C. Notice of Intent (NOI) Submittal Procedures**

1. Notice of Intent Package

Any person who is the operator of a storm water discharge associated with construction activity which requires coverage under the General Permit as stated in Part I.B. of this General Permit shall submit a complete Notice of Intent (NOI) package to the Department.\* The complete NOI package consists of:

- a. An NOI completed on a standard NOI form developed by the Department, which provides all of the required information stated in Part I.C.2. of this General Permit, and signed by the operator(s) based on the signatory requirements stated in Part V.G. and H. of this General Permit.
- b. A separate SWPPP (document and related plans) which has been completed in accordance with the requirements identified in Part IV. of this General Permit and signed by the operator(s) based on the signatory requirements stated in Part V.G. and H. of this General Permit.
- c. The application fee and first year annual fee, as required by ARM 17.30.201. (Note: New fee rules including fee amounts are effective as of February 2002.)

\* For a storm water discharge associated with construction activity with construction-related disturbance under 5 acres of total land area, an NOI package is not required until the Department formally incorporates EPA Phase II requirements into the Administrative Rules of Montana.

2. NOI Form

The NOI form requires, at a minimum, the following information:

- a. Name and address of all construction activity operator(s) as defined in Part V.T.8. of this General Permit.
- b. Contact person and telephone number for all construction activity operator(s).
- c. Construction project/site name, address, and county (for MDT projects, also provide project number and designation).

- d. Project site latitude and longitude for the center of the construction activity's disturbance, or the endpoints for lineal projects (in degrees, minutes, and seconds).
- e. Name of receiving surface waters. Indicate the nearest perennial surface water body receiving the storm water discharge and include a description of the flow path(s) for the storm water discharges to these receiving surface waters and the approximate distances as necessary (such as through ditches, coulees, other ephemeral streams, and/or intermittent streams). Indicate whether storm water will be discharging to a municipally owned storm sewer system; if so, indicate the receiving surface waters and a description of the flow path(s) as is pertinent.
- f. Estimated construction start date and completion date through site final stabilization.
- g. A USGS topographic map indicating the location of the project and nearby surface waters.
- h. An estimate of the area (in acres) to be disturbed due to construction-related activity.
- i. A brief description of the purpose and nature of the construction activity.
- j. An indication of the type of construction activity fee submitted based on Part V.S. of this General Permit. This must be either a "commercial or public" construction activity, or a "residential (single family dwelling)" construction activity. If residential (single family dwelling) is indicated, a description of the scope of the overall construction project supporting this fee type category must also be indicated.
- k. If multiple operators are identified, an indication of which operator(s) is responsible for the submittal of fees to the Department (such as future annual fees).
- l. If multiple operators are identified, an indication of which operator is responsible for the submittal of the Notice of Termination form. This must include an indication of which operator has primary responsibility, and what those responsibilities are, during major construction phases, particularly after earthwork is completed and through final stabilization. If only one operator is identified as the responsible party for final stabilization and, consequently, the submittal of the Notice of Termination form, then this operator

shall also be the responsible party for fees identified in Part I.C.2.k. above.

3. NOI Package Submittal

A signed and complete NOI form, a signed and complete SWPPP, and the required application and annual fees must be submitted to the following address:

Montana Department of Environmental Quality  
Water Protection Bureau  
Storm Water Program  
1520 East Sixth Avenue  
PO Box 200901  
Helena, MT 59620-0901

4. NOI Package Receipt Confirmation Letter

The Department will provide all identified operator(s) on the NOI form with a Confirmation Letter acknowledging the receipt of the complete Notice of Intent package.

Receipt by the Department of the complete NOI package by the construction start date where construction-related disturbance will initiate shall provide coverage to discharge storm water under the General Permit. If any of the required items in the NOI package are not complete or are not submitted to the Department, coverage for storm water discharge associated with construction activity under the General Permit will not initiate until the required items are received by the Department.

Receipt by the Department of the complete NOI package constitutes a full agreement by the operator(s) to meet and comply with all requirements stated in this General Permit.

The operator(s) should submit complete NOI packages, with all components submitted at the same time, to ensure efficient NOI processing by the Department, to prevent delay of construction activity, and to minimize potential storm water discharge compliance problems.

5. NOI Submittal Requirements for Permittees Authorized under the Preceding 1997-2002 General Discharge Permit for Storm Water Associated with Construction Activity

The operator(s) of ongoing construction projects as of the effective date of this General Permit, which have an active permit authorization under the

1997-2002 General Discharge Permit for Storm Water Associated with Construction Activity, shall:

- a. Submit an NOI package according to Part I.C.1., 2., and 3. of this General Permit within 90 days of the effective date of this General Permit. If the operator(s) is eligible to submit a Notice of Termination under Part V.R. of this General Permit (e.g., construction is finished and final stabilization has been achieved) before the 90<sup>th</sup> day, an NOI package is not required to be submitted.
- b. For the first 90 days from the effective date of this General Permit, comply with the terms and conditions of the 1997-2002 General Discharge Permit for Storm Water Associated with Construction Activity, except that, for Notice of Terminations, the requirements of Part V.R. in this 2002-2006 General Permit shall apply.
- c. Update their SWPPP to comply with the requirements of Part IV. of this General Permit within 90 days after the effective date of this General Permit.
- d. If a Notice of Termination is not to be submitted before the 90<sup>th</sup> day after the effective date of this General Permit (e.g., construction is not finished and/or final stabilization has not been achieved by this date), submit an NOI fee according to ARM 17.30.201 with the NOI form. This fee will be waived if the original permit application for authorization under the 1997-2002 General Permit was stamp-received by the Department between January 1, 2002 and the effective date of this 2002-2006 General Permit.

**PART II. EFFLUENT LIMITATIONS AND SPECIAL CONDITIONS**

Effective immediately upon the submittal of a complete Notice of Intent package for coverage under this General Permit and lasting through the expiration date, the following effluent limitations apply.

- A. There must be no discharge of process wastewater pollutants to surface waters. Discharges to surface waters of material other than storm water must be in compliance with a Montana Pollutant Discharge Elimination System (MPDES) permit other than this General Permit.**
- B. All discharges to surface waters covered by this General Permit must be composed entirely of storm water. Discharges must consist of water generated only through rainfall precipitation and snowmelt.**
- C. A discharge of storm water associated with construction activity must not cause or contribute to a violation of water quality standards.**
- D. The operator(s) shall develop and maintain all BMPs and storm water management controls in accordance with the SWPPP required in Part IV. of this General Permit.**

**PART III. MONITORING, REPORTING, AND RECORDS RETENTION REQUIREMENTS**

**A. Monitoring Requirements**

1. The operator(s) shall implement and maintain Best Management Practices (BMPs) to minimize potential pollutants in storm water discharges, as identified in the SWPPP.
2. Storm water discharges associated with construction activity must be monitored by the operator(s) as specified in this section to evaluate the adequacy and effectiveness of the erosion and sediment control measures and BMPs.
3. All erosion and sediment control measures must be inspected and maintained by or under the direction of the operator(s) at least once every fourteen calendar days and within 24 hours after any storm event of 0.5 inches or greater.
4. The frequency of the inspections required in Part III.A.3. may be reduced to monthly, as follows:
  - a. After the operator(s) has completed earthwork and construction activities at the construction site and has installed the SWPPP erosion and sediment control measures and other BMPs necessary to establish final stabilization at a later date, or
  - b. Between December 1 and March 1.

In either case, all sediment and erosion control measures and other BMPs must be in place as identified in the SWPPP. This change in inspection frequency and its schedule for implementation must be indicated in the SWPPP.

5. All inspections and monitoring performed above under Part III.A.3. and 4. of this General Permit must be documented and kept in accordance with Part III.C.2. and 3. of this General Permit.
6. The operator(s) of a storm water discharge associated with construction activity with construction-related disturbance of 5 acres or more of total land area, which has had active General Permit coverage for 1 year or more, shall perform an annual inspection of the site by the 1 year

anniversary date of the submittal of the NOI package or the initiation of active permit coverage. The annual inspection must:

- a. Identify areas contributing to the storm water discharge associated with construction activity and evaluate whether measures to reduce pollutant loadings identified in the SWPPP are adequate and properly implemented in accordance with the requirements in this General Permit or whether additional controls are needed.
- b. Be summarized in a report that includes a certification of compliance with the SWPPP and General Permit and any incidents of non-compliance. Such report and certification must be signed in accordance with the signatory requirements of Part V.G. and H. of this General Permit. This inspection record, report, and certification must be maintained in accordance with Part III.C.2. and C.3. of this General Permit.

**B. Reporting Requirements**

1. Notification of Facility Contact Changes

The operator(s) shall notify the Department in writing of any change of the designated contact person, mailing address, and/or telephone number (as originally identified in the Notice of Intent) within 15 calendar days of this change.

2. Spill/Release Notification

The operator(s) shall submit written notification to the Department Storm Water Program (mailing address is stated in Part I.C.3. of this General Permit) within two business days of the detection of any unregulated significant spill or release in any area(s) which has the potential to introduce pollutants into storm water runoff other than sediment. This notification must provide: the Notice of Intent number; the name of the construction activity project; the operator(s) as identified on the Notice of Intent form; a description of the time and duration of the spill/release; the specific location and contaminant fate of the spill/release; a description of the quantity and type of material spilled/released; measures being taken to investigate and/or remediate the spill/release; any known or potential impacts to storm water discharges due to the spill/release; and any BMPs to be implemented to minimize and/or prevent similar spills/releases in the future.

3. Noncompliance Reporting

If, for any reason, the operator(s) does not comply with or will be unable to comply with any condition specified in this General Permit, the

operator(s) shall notify the Department as soon as possible by phone and provide the Department with the following information, in writing, within five calendar days of becoming aware of such condition:

- a. A description of the discharge or other cause of noncompliance;
  - b. The period of noncompliance, including exact dates and times; or, if not identified, the anticipated time the noncompliance is expected to continue; and,
  - c. Additional measures being taken to reduce, eliminate, and prevent recurrences of the non-complying discharge or other cause of noncompliance.
4. All reports, notifications, and inquiries regarding the conditions of this General Permit must be provided to the Department at:

Montana Department of Environmental Quality  
Water Protection Bureau  
Storm Water Program  
1520 East Sixth Avenue  
PO Box 200901  
Helena, MT 59620-0901  
(406) 444-3080

**C. Records Retention**

1. Permit Retention Requirements

The operator shall retain a copy of this General Permit, a copy of the completed and signed Notice of Intent form, a copy of the Department's Confirmation Letter for receipt of the Notice of Intent package, and a copy of the completed and signed Storm Water Pollution Prevention Plan (SWPPP) at the construction activity project site at all times during the active coverage period provided under this General Permit. If no permanent offices/buildings are located at the facility site, copies of these documents must be retained at the office of the operator's contact person identified on the Notice of Intent form and at the office of the primary operator(s) responsible for the implementation of the SWPPP and must be brought to the site at all times with these identified operator(s). If the person(s) designated as responsible contact/individual is replaced during the active coverage period provided under this General Permit, the operator(s) shall ensure measures are in place to transfer and familiarize replacement personnel with the requirements pertaining to these documents.

2. Inspection and Uncontrolled Release Records

The operator(s) shall keep a record of inspections, the date and time inspected, and the name of the person performing the inspection. Uncontrolled releases of mud or muddy water or "significant sediment" (as defined in Part V.T.13. of this General Permit) found off the site or entering into surface waters must be recorded with a brief explanation as to the measures taken to prevent future releases as well as any measures taken to clean up the sediment that has left the site. This inspection record must be made available to the Department upon request. Any occurrence of noncompliance must be reported according to Part III.B.3. of this General Permit.

3. Required Period of Record Retention

All records and information resulting from the monitoring activities required by this General Permit, a copy of the completed and signed NOI form, a copy of the DEQ NOI Package Receipt Confirmation Letter, and a copy of the completed and signed SWPPP shall be retained by the operator(s) for a minimum of 3 years from the date the site is finally stabilized, or longer if requested by the Department.

**PART IV. STORM WATER POLLUTION PREVENTION PLAN**

- A. The operator(s) shall develop a Storm Water Pollution Prevention Plan (SWPPP) and submit a copy of the SWPPP at the same time as the Notice of Intent form. This operator shall implement the SWPPP at the time construction activity commences. The objective of the SWPPP is to minimize the erosion of disturbed land during construction and post-construction activities and to minimize pollutants, such as sediment, fuels, oil, grease, fertilizer, pesticides, concrete truck washout, etc., from discharging to surface waters. It is the responsibility of the operator(s) to ensure the SWPPP requirements stated in this General Permit are complied with. Incomplete SWPPPs are a violation of this General Permit. The Department may take (or initiate) enforcement action if an operator is found to have prepared an incomplete SWPPP.

The SWPPP must:

1. Be signed in accordance with the signatory requirements in Part V.G. and H. of this General Permit,
  2. Be maintained at the construction site in accordance with Part III.C. of this General Permit, and
  3. Provide for compliance with the terms and schedule of the SWPPP and be updated as necessary.
- B. The SWPPP must be implemented for the entire duration of the project, beginning with disturbance related to construction activity and lasting through establishment of site final stabilization of disturbed areas.
- C. The Department may notify the operator(s), that the SWPPP is not in compliance with this General Permit. This determination of SWPPP deficiency may be derived through site inspection or through a review of the SWPPP. After such notification from the Department, the operator(s) shall make changes to the SWPPP and submit a written certification to the Department indicating the necessary changes have been made. Unless otherwise provided by the Department, the operator(s) shall have seven calendar days after such notification to make the necessary changes to the SWPPP. When the Department makes such notification, the operator(s) shall provide the Department with a copy of revisions to the SWPPP.
- D. The operator(s) shall amend the SWPPP whenever there is a change in design, construction, operation, or maintenance, which has a significant effect on the potential for the discharge of pollutants to surface waters, or if the SWPPP proves to be ineffective in achieving the general objectives of controlling pollutants in a storm water discharge associated with construction activity. When such revisions

are made to the SWPPP based upon this General Permit condition, the operator(s) shall provide the Department with a copy of revisions to the SWPPP.

- E. The SWPPP may include any erosion and sediment control measures or Best Management Practices (BMPs), including but not limited to the use of sediment basins, berms, barriers, filter strips, covers, diversion structures, seeding, and sodding.
- F. Any SWPPP that is prepared for a construction activity which includes 20 acres or more in total disturbance related to construction activity, must be reviewed and stamped by a professional engineer licensed in the State of Montana.
- G. The SWPPP must include at least the following items:
  1. Site Description: Each plan must at a minimum, provide a description of the following:
    - a. The nature of the construction activity, including a proposed implementation schedule for major activities;
    - b. Estimates of the total area of the site, and all other sites if a phased development project, and the area of the site that is expected to undergo disturbance related to construction activity;
    - c. Site map(s) indicating:
      - Areas of total development and, at a minimum, areas of "disturbance" related to construction activity (including support activities related to a construction site . concrete or asphalt batch plants, equipment staging yards, material storage areas, material borrow areas, etc.);
      - Drainage patterns;
      - Approximate slopes anticipated after major grading activities;
      - Areas used for the storage of soils or wastes;
      - Areas used for the storage of fuel(s);
      - Location of all erosion and sediment control measures or structures;
      - Areas where vegetative measures are to be implemented;
      - The location of impervious structures (including buildings, roads, parking lots, outdoor storage areas, etc.) after construction is completed;
      - The location of all surface waters on or near to the construction activity site (including perennial and intermittent waterbodies, ephemeral streams, springs, wetlands with standing water, etc.),

- The boundary of the 100-year floodplain, if determined;  
and
  - A north arrow and map scale;
- d. The character and erodibility of sediment and other earth material to be disturbed at the project site, including cut/fill material to be used;
- e. For a storm water discharge associated with construction activity with construction-related disturbance of 5 acres or more of total land area, an estimate of the runoff coefficient of the site and the increase in impervious area after the construction addressed in the NOI is completed;
- f. The names of receiving surface waters and a description of the size, type, and location of each point source discharge or outfall. If there is no distinguishable point source discharge or outfall to the receiving surface waters, a description of storm water runoff flow and drainage patterns into the receiving surface waters must be provided. If the discharge is to a municipal separate storm sewer, the location of any storm sewer discharge into receiving surface waters; and
- g. A description of storm water discharges from support activities related to a construction site (e.g. concrete or asphalt batch plants, equipment staging yards, material storage areas, etc.).

2. BMPs and Storm Water Management Controls

Each operator(s) covered by this General Permit shall develop, as part of the SWPPP, a description of BMPs and storm water management controls appropriate for the site, including a brief description of applicable local erosion and sediment control requirements. The following minimum components must be addressed, including a schedule for implementation, unless otherwise authorized in writing by the Department.

- a. A description of stabilization measures which must, to the degree practicable, preserve existing vegetation and re-vegetate areas of construction-related disturbance as soon as possible after grading or construction. In developing vegetative measures, the operator(s) shall consider: temporary seeding, permanent seeding, mulching, sod stabilization, vegetative buffer/filter strips, grassed waterways, erosion control blankets, and tree and shrub planting.
- b. A description of structural measures which indicates how, to the degree practicable, the operator(s) will divert storm water flows

from exposed soil, store these flows, or otherwise limit runoff from exposed areas of the site. In developing structural measures, the operator(s) shall consider: straw bale dikes, silt fences, earth dikes, brush barriers, drainage swales, check dams, subsurface drains, pipe slope drains, rock outlet protection, drain inlet and outlet protection, temporary drain diversions, sediment traps, temporary sediment basins, infiltration trenches or basins, and retaining walls. The operator(s) should also consider the proximity of structural measures with respect to floodplains, and if there are other alternatives, avoid the placement of structural BMPs within the floodplain.

- c. None of the temporary control structures, including silt fences and straw bale dikes, shall be removed until permanent vegetation and site stabilization has taken place. The only exception to this would be where temporary control structures need to be moved or removed in order to allow continuing construction activities to occur, in which case equivalent measures must be implemented to ensure the same level of protection in minimizing potential pollutant discharges.
  - d. Off-site vehicle tracking of sediments from the construction site must be controlled or minimized, particularly onto paved road surfaces, in order to minimize the potential impairment of storm water quality.
  - e. When trucking saturated soils from the site, either tight leak-proof trucks must be used or loads must be required to drain until drippage has been reduced to less than 1 gallon per hour before leaving the site.
- H. BMPs must minimize or prevent "significant sediment" (as defined in Part V.T.13. of this General Permit) from leaving the construction site.
- I. If "significant sediment" (as defined in Part V.T.13. of this General Permit) results from the failure of erosion or sediment control measures, the operator(s) shall evaluate the effectiveness of such measures or other BMPs and incorporate improvements to minimize the potential for "significant sediment".
- J. If "significant sediment" (as defined in Part V.T.13. of this General Permit) results from the failure of erosion or sediment control measures, the material must be cleaned up and placed back on the site or disposed of in an acceptable manner. The material must not be washed into the storm sewer(s), drainageway(s), or receiving surface waters. This does not waive any obligations for the operator(s) to obtain other permits or permissions to clean up the "significant sediment."

- K. A description of measures to control pollutants in storm water discharges that will occur after construction operations have been completed must be addressed in the SWPPP, including a brief description of applicable local erosion and sediment control requirements. Such measures may include: storm water detention structures (including wet ponds), storm water retention structures, flow attenuation by use of open vegetated swales and natural depressions, and infiltration of runoff on-site.

**PART V. STANDARD CONDITIONS**

**A. Duty to Comply**

The operator(s) shall comply with all conditions of this General Permit. Any General Permit noncompliance constitutes a violation of the Act and is grounds for enforcement action, for termination of coverage under the General Permit, revocation and reissuance, modification of coverage under the General Permit, or for denial of General Permit coverage renewal. The operator(s) shall give the Department advance notice of any planned changes at the permitted activity that may result in permit noncompliance.

The Montana Water Quality Act (75-5-631, MCA) and the federal Clean Water Act (Section 309) provide significant penalties for any person who violates a General Permit condition. Any person who violates any condition of this General Permit is subject to a civil penalty not to exceed \$25,000 per day per violation, or an administrative penalty not to exceed \$10,000 per day per violation, as well as any other appropriate sanction provided by Section 309 of the Clean Water Act.

**B. Continuation of the Expired General Permit**

An expired General Permit remains in full force and effect until the General Permit is reissued. Those operator(s) who submitted Notices of Intent prior to the expiration date or who were granted coverage under the General Permit before it expired, are covered by the expired permit until the General Permit is reissued.

**C. Need to Halt or Reduce Activity not a Defense**

It shall not be a defense for an operator(s) in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this General Permit.

**D. Duty to Mitigate**

The operator(s) shall take all reasonable steps to minimize or prevent any discharge in violation of this General Permit that has a reasonable likelihood of adversely affecting human health or the environment.

**E. Duty to Provide Information**

The operator(s) shall furnish to the Department, within a reasonable time, any information which the Department may request to determine whether cause exists for modifying, revoking and reissuing, or terminating coverage under this General Permit, or to determine compliance with this General Permit. The operator(s) shall also furnish to the Department, upon request, copies of records required to be maintained under this General Permit.

**F. Other Information**

When the operator(s) becomes aware that he failed to submit any relevant facts or submitted incorrect information in a Notice of Intent package or any report to the Department, he shall promptly submit such facts or information.

**G. Signatory Requirements**

All Notices of Intent, SWPPPs, Notices of Termination, and reports or information, must be signed and certified.

1. All Notices of Intent, SWPPPs, Notices of Termination, and reports required by this General Permit must be signed by the following persons or by a duly authorized representative of these persons as provided in Part V.G.2. of this General Permit:
  - a. For a corporation, by a responsible corporate officer;
  - b. For a partnership or sole proprietorship, by a general partner or the proprietor, respectively;
  - c. For a municipality, state, federal, or other public agency, by either a principal executive officer or ranking elected official.
2. A person is a duly authorized representative of the person stated above in Part V.G.1. of this General Permit only if:
  - a. The authorization is made in writing by the person stated in Part V.G.1. of this General Permit and submitted to the Department, and
  - b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company (A duly authorized representative may thus be either a named individual or any individual occupying a named position).
3. Changes to authorization. If an authorization under Part V.G.2. of this General Permit is no longer accurate because a different individual or position has responsibility for the overall operation of the facility or activity, a new authorization satisfying the requirements of Part V.G.2. of this General Permit must be submitted to the Department prior to, or together

with, any SWPPP revisions, reports, or other information requiring the signature of a duly authorized representative.

**H. Certification**

Any person signing a document required under this General Permit shall make the following certification:

"I certify under penalty of the law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

**I. Penalties for False Statements and Falsifying Monitoring**

Under Section 75-5-633, MCA, the Montana Water Quality Act provides that any person who knowingly makes any false statement, representation, or certification in any Notice of Intent, record, report, plan, or other document filed or required to be maintained under this General Permit or who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this General Permit shall upon conviction be punished by a fine of not more than \$25,000 or by imprisonment for not more than 6 months or both.

**J. Oil and Hazardous Substance Liability**

Nothing in this General Permit shall be construed to preclude the institution of any legal action or relieve the operator(s) from any responsibilities, liabilities, or penalties to which the operator(s) is or may be subject under Section 311 of the Clean Water Act.

**K. Property Rights**

The issuance of this General Permit does not convey any property rights of any sort, nor any exclusive privileges, nor does it authorize any injury to private property, nor any invasion of personal rights, nor any infringement of federal, state, or local laws or regulations.

**L. Severability**

The provisions of this General Permit are severable, and if any provision of this General Permit, or the application of any provision of this General Permit to any

circumstance, is held invalid, the application of such provision to other circumstances and the remainder of this General Permit shall not be affected thereby.

**M. Transfers**

A Notice of Intent cannot be transferred to a new operator(s). A new operator of a facility must submit a new Notice of Intent package according to the procedures in Part I.C. of this Permit prior to taking responsibility for the construction activity. If the new operator(s) chooses to develop a new SWPPP, the new operator(s) shall be expected to implement the old SWPPP until the new plan is developed, implemented, and submitted to the DEQ.

**N. Proper Operation and Maintenance**

The operator(s) shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the operator(s) to achieve compliance with the conditions of this General Permit and with the requirements of Storm Water Pollution Prevention Plans. Proper operation and maintenance includes adequate laboratory controls and appropriate quality assurance procedures. Proper operation and maintenance require the operation of backup or auxiliary facilities or similar systems, installed by an operator(s) only when necessary to achieve compliance with the conditions of the General Permit.

**O. Inspection and Entry**

The operator(s) shall allow the Department or the Regional Administrator, or authorized representative thereof, upon the presentation of credentials and other documents as may be required by law, to:

1. At reasonable times, enter upon the operator(s)'s premises where a regulated facility or activity is located or conducted or where records must be kept under the conditions of this General Permit;
2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this General Permit;
3. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), measures, or operations regulated or required under this General Permit; and
4. Sample or monitor at reasonable times, for the purpose of assuring permit compliance, any substances or parameters at any location.

**P. Permit Actions**

Coverage under this General Permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the operator(s) for a modification, revocation and reissuance, or termination, or notification of planned changes or anticipated noncompliance, does not stay any General Permit condition.

**Q. Reopener Provision**

If there is evidence indicating an exceedance of a water quality standard due to any storm water discharge associated with construction activity that is covered by this General Permit, the operator(s) may be required to develop and implement a corrective action plan, which may include additional BMPs or the need to apply for and obtain coverage under an individual MPDES permit.

**R. Notice of Termination (NOT)**

1. Where a site has been finally stabilized or where the operator(s) at a site changes, the operator(s) shall submit a standard DEQ Notice of Termination (NOT) form that has been signed in accordance with Part V.G. and H. of this General Permit. The standard DEQ Notice of Termination form that is used must be the 2002 updated version (or a subsequent revision) and must include the following information:
  - a. The mailing address of the construction activity site. Where a mailing address for the site is not available, the location of the site must be described by the latitude and longitude for the center of the construction activity disturbance, or the endpoints for lineal projects (in degrees, minutes, and seconds);
  - b. The name, address, and telephone number of the operator(s) as identified in the Notice of Intent;
  - c. The MPDES Notice of Intent number as stated in the NOI Package Receipt Confirmation Letter described in Part I.C.4. of this General Permit;
  - d. Certification indicating the site has achieved final stabilization, or the operator(s) of the project has changed; and
  - e. The Notice of Termination form must be signed in accordance with Part V.G. and include the signature certification in accordance with Part V.H. of this General Permit. The Notice of Termination must be sent to the following address:

Montana Department of Environmental Quality  
Water Protection Bureau  
Storm Water Program  
1520 East Sixth Avenue  
PO Box 200901  
Helena, MT 59620-0901

Failure to submit a Notice of Termination shall result in additional annual permit fee accumulation until notification has been received.

2. For the operator(s) identified on the Notice of Intent form submitted to the Department, only one Notice of Termination form shall be submitted when final stabilization of disturbed areas associated with the construction activity has been satisfactorily accomplished.
3. If more than one operator is stated on the Notice of Intent form and an operator(s) desires to be relieved of responsibility for a particular portion and/or period of the General Permit coverage period, then the operator(s) shall so indicate on the Notice of Intent form when it is submitted. Consequently, the Notice of Intent form must specify which operator is responsible for the submittal of the Notice of Termination. This would typically pertain to situations where a hired contractor has completed earthwork activities and the owner elects to accept sole responsibility for compliance with the General Permit (including annual fees) from the cessation of earthwork activities through final stabilization of the site and the formal submittal of the Notice of Termination form.

**S. Fees**

1. The operator(s) is required to submit payment of an annual fee as set forth in ARM 17.30.201. (Note: New fee rules (including fee amounts) are effective as of February 2002.) When there is more than one operator specified on the Notice of Intent form, there shall be an indication of which operator is responsible for payment of the annual fees. If the operator(s) fails to pay the annual fee within 90 days after the due date for the payment, the Department may:
  - a. Impose an additional assessment consisting of 15 percent of the fee, plus interest, on the required fee computed at the rate established under 15-31-510(3), MCA; or
  - b. Suspend the effective date of the Notice of Intent for General Permit coverage or, if the nonpayment involves an annual permit fee, suspend the coverage under the General Permit for which the fee is required. The Department may lift suspension at any time up to 1 year after the suspension occurs if the holder has paid all

outstanding fees, including all penalties, assessments, and interest imposed under this sub-section. Suspensions are limited to 1 year, after which the coverage under the General Permit through the Notice of Intent will be terminated.

2. Fees submitted for storm water discharges associated with construction activity are divided into two categories based on the following:
  - a. A "residential (single family dwelling)" construction activity is the construction of any building, structure, access, utility, or related disturbance utilized for single family occupancy on a distinct and individual lot or parcel of land and that is not combined with or a part of construction activity related to other lots, parcels of land, or single family dwellings; and
  - b. A "commercial or public" construction activity is a construction activity that does not meet the above criteria as a "residential (single family dwelling)" construction activity and that includes the development of subdivisions and other projects which are part of a common plan for development or sale.

An indication of which of these two categories a construction activity meets must be provided on the NOI form as required in Part I.C.2.j. of this General Permit.

**T. Definitions**

1. The "Act" means the Federal Clean Water Act.
2. "Best Management Practices" ("BMPs") means schedule of activities, prohibition of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of state waters. BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.
3. The "Department" means the Montana Department of Environmental Quality.
4. "Disturbance" related to construction activity means areas that are subject to clearing, excavating, grading, stockpiling earth materials, and placement/removal of earth material performed during construction projects.
5. "Ephemeral stream" means a stream or part of a stream that flows only in direct response to precipitation in the immediate watershed or in response to

the melting of a cover of snow and ice and whose channel bottom is always above the local water table.

6. "Final stabilization" means all soil disturbing activities at the site have been completed, and a vegetative cover has been established with a density of at least 70 percent of the pre-disturbance levels, or equivalent permanent, physical erosion reduction methods have been employed. Final stabilization using vegetation shall be accomplished using seeding mixtures or forbs, grasses, and shrubs, which are adapted to the conditions of the site. Establishment of a vegetative cover capable of providing erosion control equivalent to pre-existing conditions at the site will be considered final stabilization.
7. "Larger common plan of development or sale" means a contiguous area where multiple separate and distinct construction activities are planned to occur at different times on different schedules under one plan. These separate and distinct construction activities which form a larger common plan of development or sale may have areas of disturbance which are not physically connected.
8. "Operator" for the purpose of permitting "storm water discharge associated with construction activity" means any "owner or operator" as defined in ARM 17.30.1304 associated with a construction project, who is a person designated as an eligible signatory pursuant to Part V.G. of this General Permit, and who meets either of the following two criteria:
  - a. The party has operational control over construction plans and specifications, including the ability to make modifications to those plans and specifications; or
  - b. The party has day-to-day operational control of those activities at a project which are necessary to ensure compliance with a Storm Water Pollution Prevention Plan for the site or other General Permit conditions (e.g., is authorized to direct workers at a site to carry out activities required by the SWPPP or comply with other permit conditions).

If multiple operators are identified on the Notice of Intent form, a particular operator may be an "operator" for a particular segment or phase of the construction activity and/or "storm water discharge associated with construction activity". An example is if contracted help is used for earthwork, but not through to final stabilization of the site.

An "operator" is not a person(s) at the construction project site employed by the designated eligible signatory pursuant to Part V.G. of this General Permit (such as construction equipment users).

An "operator" shall be considered to have operational control over all their subcontractors.

9. "Point source" means any discernible, confined, or discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel or other floating craft, from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture or agricultural storm water runoff.
10. "Receiving surface waters" is the river, stream, lake, etc., which receives the discharge from the site.
11. "Regional administrator" means the administrator of Region VIII of the Environmental Protection Agency, which has jurisdiction over federal water pollution control activities in the state of Montana.
12. "Runoff coefficient" means the fraction of total rainfall that will appear at the conveyance as runoff.
13. "Significant sediment" means mud, dirt, sediment, or similar material exceeding 1.0 cubic foot in volume which is deposited in any area of 100 square feet or less on public or private streets or property adjacent to the construction site. "Deposited" includes direct deposit, dropping, discharge, or placement as a result of erosion.
14. "Storm water" means storm water runoff, snow melt runoff, and surface runoff and drainage.
15. "Storm water discharge associated with construction activity" means a discharge from construction activity due to disturbance from clearing, grading and excavation, except operations that result in the disturbance of less than 1 acre of total land area. Construction activity also includes the disturbance of less than 1 acre of total land area that is a part of a larger common plan of development or sale if the larger common plan will ultimately disturb 1 acre or more. Irregardless of the acreage of disturbance for a construction activity, this definition includes any other construction activity designated by the Department based on the potential for contribution to a violation of a water quality standard or for significant contribution of pollutants to surface waters. For storm water discharge associated with a construction activity which has disturbance less than 5 acres, the acreage of disturbance does not include routine maintenance that is performed to maintain the original line and grade, hydraulic capacity, or original purpose of the facility.

16. "SWPPP" or "Storm Water Pollution Prevention Plan" means a document developed to help identify sources of pollution potentially affecting the quality of storm water discharges associated with a facility or activity and to ensure implementation of measures to minimize and control pollutants in storm water discharges associated with a facility or activity. The Department determines specific requirements and information to be included in a SWPPP based on the type and characteristics of a facility or an activity and on the respective MPDES permit requirements.
17. "Surface waters" means any waters on the earth's surface including, but not limited to, streams, lakes, ponds, and reservoirs and irrigation and drainage systems discharging directly into a stream, lake, pond, reservoir or other surface water. Water bodies used solely for treating, transporting, or impounding pollutants shall not be considered surface water.

SITE INSPECTION REPORT FORM	
Project Name: Fish Hatchery Rearing Ponds and Hatchery	Location: Ft Peck, MT
Name of Inspector:	
Date of Inspection:	Time of Inspection:

**INSPECTION CHECKLIST:**

PRACTICE	MAINTENANCE REQUIRED
Disturbed Areas	
Material Storage Areas	
Temporary Seeding	
Mulching	
Erosion Control Blanket	
Permanent Seeding	
Silt Fence	
Storm Drain Inlet Protection	
Outlet Protection	

Changes required to Erosion Control Plan (ECP):		
Reasons for changes:		
		Date ECP was revised:
The Facility is in compliance with the ECP and MPDES Permit?	Yes:	No:
<p>I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.</p>		
_____	_____	_____
[Contractor]		Date

Uncontrolled releases of mud or muddy water or measurable quantities of sediment found off the site or entering into state waters shall be recorded with a brief explanation as to the measures taken to prevent future releases as well as any measures taken to clean up the sediment that has left the site. Action shall be taken within 24 hours of discovery to reduce the discharge of sediments.

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RECYCLED / RECOVERED MATERIALS

**12/01**

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## SECTION 01670

## RECYCLED / RECOVERED MATERIALS

12/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 247

Comprehensive Procurement Guideline for  
Products Containing Recovered Materials

## 1.2 OBJECTIVES

Government procurement policy is to acquire, in a cost effective manner, items containing the highest percentage of recycled and recovered materials practicable consistent with maintaining a satisfactory level of competition without adversely affecting performance requirements or exposing suppliers' employees to undue hazards from the recovered materials. The Environmental Protection Agency (EPA) has designated certain items which must contain a specified percent range of recovered or recycled materials. EPA designated products specified in this contract comply with the stated policy and with the EPA guidelines. The Contractor shall make all reasonable efforts to use recycled and recovered materials in providing the EPA designated products and in otherwise utilizing recycled and recovered materials in the execution of the work.

## 1.3 EPA DESIGNATED ITEMS INCORPORATED IN THE WORK

Various sections of the specifications contain requirements for materials that have been designated by EPA as being products which are or can be made with recovered or recycled materials. These items, when incorporated into the work under this contract, shall contain at least the specified percentage of recycled or recovered materials unless adequate justification (non-availability) for non-use is provided. When a designated item is specified as an option to a non-designated item, the designated item requirements apply only if the designated item is used in the work.

## 1.4 EPA PROPOSED ITEMS INCORPORATED IN THE WORK

Products other than those designated by EPA are still being researched and are being considered for future Comprehensive Procurement Guideline (CPG) designation. It is recommended that these items, when incorporated in the work under this contract, contain the highest practicable percentage of recycled or recovered materials, provided specified requirements are also met.

## 1.5 EPA LISTED ITEMS USED IN CONDUCT OF THE WORK BUT NOT INCORPORATED IN

## THE WORK

There are many products listed in 40 CFR 247 which have been designated or proposed by EPA to include recycled or recovered materials that may be used by the Contractor in performing the work but will not be incorporated into the work. These products include office products, temporary traffic control products, and pallets. It is recommended that these non-construction products, when used in the conduct of the work, contain the highest practicable percentage of recycled or recovered materials and that these products be recycled when no longer needed.

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-- End of Section Table of Contents --

## SECTION 01781

OPERATION AND MAINTENANCE DATA  
12/01

## PART 1 GENERAL

## 1.1 SUBMISSION OF OPERATION AND MAINTENANCE DATA

Submit Operation and Maintenance (O&M) Data specifically applicable to this contract and a complete and concise depiction of the provided equipment, product, or system. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with this section and Section 01330, "Submittal Procedures."

## 1.1.1 Package Quality

Documents must be fully legible. Poor quality copies and material with hole punches obliterating the text or drawings will not be accepted.

## 1.1.2 Package Content

Data package content shall be as shown in the paragraph titled "Schedule of Operation and Maintenance Data Packages." Comply with the data package requirements specified in the individual technical sections, including the content of the packages and addressing each product, component, and system designated for data package submission.

## 1.1.3 Changes to Submittals

Manufacturer-originated changes or revisions to submitted data shall be furnished by the Contractor if a component of an item is so affected subsequent to acceptance of the O&M Data. Changes, additions, or revisions required by the Contracting Officer for final acceptance of submitted data, shall be submitted by the Contractor within 30 calendar days of the notification of this change requirement.

## 1.2 TYPES OF INFORMATION REQUIRED IN O&amp;M DATA PACKAGES

## 1.2.1 Operating Instructions

Include specific instructions, procedures, and illustrations for the following phases of operation:

## 1.2.1.1 Safety Precautions

List personnel hazards and equipment or product safety precautions for all operating conditions.

## 1.2.1.2 Operator Prestart

Include procedures required to set up and prepare each system for use.

## 1.2.1.3 Startup, Shutdown, and Post-Shutdown Procedures

Provide narrative description for Startup, Shutdown and Post-shutdown operating procedures including the control sequence for each procedure.

#### 1.2.1.4 Normal Operations

Provide narrative description of Normal Operating Procedures. Include Control Diagrams with data to explain operation and control of systems and specific equipment.

#### 1.2.1.5 Emergency Operations

Include Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include Emergency Shutdown Instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance and procedures for emergency operation of all utility systems including required valve positions, valve locations and zones or portions of systems controlled.

#### 1.2.1.6 Operator Service Requirements

Include instructions for services to be performed by the operator such as lubrication, adjustment, inspection, and recording gage readings.

#### 1.2.1.7 Environmental Conditions

Include a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each product, component or system. Describe conditions under which the item equipment should not be allowed to run.

### 1.2.2 Preventive Maintenance

Include the following information for preventive and scheduled maintenance to minimize corrective maintenance and repair.

#### 1.2.2.1 Lubrication Data

Include preventative maintenance lubrication data, in addition to instructions for lubrication provided under paragraph titled "Operator Service Requirements":

- a. A table showing recommended lubricants for specific temperature ranges and applications.
- b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities.
- c. A Lubrication Schedule showing service interval frequency.

#### 1.2.2.2 Preventive Maintenance Plan and Schedule

Include manufacturer's schedule for routine preventive maintenance, inspections, tests and adjustments required to ensure proper and economical operation and to minimize corrective maintenance. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufacturer's specified frequency and

procedures for each separate operation.

### 1.2.3 Corrective Maintenance (Repair)

Include manufacturer's recommended procedures and instructions for correcting problems and making repairs.

#### 1.2.3.1 Troubleshooting Guides and Diagnostic Techniques

Include step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

#### 1.2.3.2 Wiring Diagrams and Control Diagrams

Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation configuration and numbering.

#### 1.2.3.3 Maintenance and Repair Procedures

Include instructions and a list of tools required to repair or restore the product or equipment to proper condition or operating standards.

#### 1.2.3.4 Removal and Replacement Instructions

Include step-by-step procedures and a list required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Instructions shall include a combination of text and illustrations.

#### 1.2.3.5 Spare Parts and Supply Lists

Include lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead-time to obtain.

### 1.2.4 Corrective Maintenance Work-Hours

Include manufacturer's projection of corrective maintenance work-hours including requirements by type of craft. Corrective maintenance that requires completion or participation of the equipment manufacturer shall be identified and tabulated separately.

### 1.2.5 Appendices

Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment.

### 1.2.6 Parts Identification

Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number that will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies in accordance with the manufacturer's standard practice. Parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as typically shown in a master parts catalog.

#### 1.2.6.1 Warranty Information

List and explain the various warranties and include the servicing and technical precautions prescribed by the manufacturers or contract documents in order to keep warranties in force. Include warranty information for primary components such as the compressor of air conditioning system.

#### 1.2.6.2 Personnel Training Requirements

Provide information available from the manufacturers that is needed for use in training designated personnel to properly operate and maintain the equipment and systems.

#### 1.2.6.3 Testing Equipment and Special Tool Information

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.

#### 1.2.6.4 Contractor Information

Provide a list that includes the name, address, and telephone number of the General Contractor and each Subcontractor who installed the product or equipment, or system. For each item, also provide the name address and telephone number of the manufacturer's representative and service organization most convenient to the project site. Provide the name, address, and telephone number of the product, equipment, and system manufacturers.

### 1.3 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

Furnish the O&M data packages specified in individual technical sections. The required information for each O&M data package is as follows:

#### 1.3.1 Data Package 3

- a. Safety precautions
- b. Normal operations
- c. Emergency operations

- d. Environmental conditions
- e. Lubrication data
- f. Preventive maintenance plan and schedule
- g. Troubleshooting guides and diagnostic techniques
- h. Wiring diagrams and control diagrams
- i. Maintenance and repair procedures
- j. Removal and replacement instructions
- k. Spare parts and supply list
- l. Parts identification
- m. Warranty information
- n. Testing equipment and special tool information
- o. Contractor information

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

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SECTION 02231

CLEARING AND GRUBBING

**07/02**

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## SECTION 02231

CLEARING AND GRUBBING  
07/02

## PART 1 GENERAL

## 1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## 1.2 DELIVERY, STORAGE, AND HANDLING

Deliver materials to, store at the site, and handle in a manner which will maintain the materials in their original manufactured or fabricated condition until ready for use.

## PART 2 PRODUCTS NOT USED

## PART 3 EXECUTION

## 3.1 PROTECTION

## 3.1.1 Roads and Walks

Keep roads and walks free of dirt and debris at all times.

## 3.1.2 Trees, Shrubs, and Existing Facilities

Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the circumstances require.

## 3.1.3 Utility Lines

Protect existing utility lines that are indicated to remain from damage. Notify the Contracting Officer immediately of damage to or an encounter with an unknown existing utility line. The Contractor shall be responsible for the repairs of damage to existing utility lines that are indicated or made known to the Contractor prior to start of clearing and grubbing operations. When utility lines which are to be removed are encountered within the area of operations, the Contractor shall notify the Contracting Officer in ample time to minimize interruption of the service.

## 3.2 CLEARING

Areas of tree removal shown on the drawings shall be cleared and grubbed. Clearing shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation

designated for removal, including downed timber, snags, brush, and rubbish occurring within the areas to be cleared. Clearing shall also include the removal and disposal of structures that obtrude, encroach upon, or otherwise obstruct the work.

### 3.3 GRUBBING

Areas of tree removal shown on the drawings shall be cleared and grubbed. Grubbing shall consist of the removal and disposal of stumps, roots larger than 3 inches in diameter, and matted roots from the designated grubbing areas.

Material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, shall be removed to a depth of not less than 18 inches below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for buildings, and areas to be paved. Depressions made by grubbing shall be filled with suitable material and compacted to make the surface conform with the original adjacent surface of the ground.

### 3.4 DISPOSAL OF MATERIALS

Logs, stumps, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations, shall be disposed of outside the limits of Government-controlled land at the Contractor's responsibility or by burning (if permitted by local, state, and federal law). Refuse to be burned shall be burned at specified locations and in a manner to prevent damage to existing structures and appurtenances, construction in progress, trees, and other vegetation. The Contractor shall be responsible for compliance with all Federal and State laws and regulations and with reasonable practice relative to the building of fires. Burning or other disposal of refuse and debris and any accidental loss or damage attendant thereto shall be the Contractor's responsibility. A copy of any permits required to burn materials shall be provided to the Contracting Officer prior to burning.

-- End of Section --

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DIVISION 02 - SITE WORK

SECTION 02300A

EARTHWORK

12/97

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3.12 SUBGRADE AND EMBANKMENT PROTECTION

-- End of Section Table of Contents --

## SECTION 02300A

EARTHWORK  
12/97

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

- AASHTO T 180 (1997) Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and an 457 mm (18-in) Drop
- AASHTO T 224 (1996) Correction for Coarse Particles in the Soil Compaction Test

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM C 136 (1996a) Sieve Analysis of Fine and Coarse Aggregates
- ASTM D 422 (1963; R 1998) Particle-Size Analysis of Soils
- ASTM D 1140 (1997) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
- ASTM D 1556 (1990; R 1996e1) Density and Unit Weight of Soil in Place by the Sand-Cone Method
- ASTM D 1557 (1991; R 1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
- ASTM D 2167 (1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
- ASTM D 2487 (1998) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
- ASTM D 2922 (1996e1) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
- ASTM D 3017 (1988; R 1996e1) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow

Depth)

ASTM D 4318

(1998) Liquid Limit, Plastic Limit, and  
Plasticity Index of Soils

## 1.2 DEFINITIONS

### 1.2.1 Satisfactory Materials

Satisfactory materials shall comprise any materials classified by ASTM D 2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP, SM, SW-SM, SC, SW-SC, SP-SM, SP-SC, CL, ML, CL-ML, or CH. Satisfactory materials for grading shall be comprised of stones less than 6 inches, except for fill material for the 6 inch compacted layer directly beneath pavements which shall be comprised of stones less than 3 inches in any dimension.

### 1.2.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root and other organic matter or frozen material. The Contracting Officer shall be notified of any contaminated materials.

### 1.2.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic. Testing required for classifying materials shall be in accordance with ASTM D 4318, ASTM C 136, ASTM D 422, and ASTM D 1140.

### 1.2.4 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated as a percent of laboratory maximum density. Since ASTM D 1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 3/4 inch sieve, the degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4 inch sieve shall be expressed as a percentage of the maximum density in accordance with AASHTO T 180 Method D and corrected with AASHTO T 224. To maintain the same percentage of coarse material, the "remove and replace" procedure as described in the NOTE 8 in Paragraph 7.2 of AASHTO T 180 shall be used.

### 1.2.5 Topsoil

Material for topsoil shall be obtained from excavations.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-03 Product Data

## Earthwork

Procedure and location for disposal of unused satisfactory material.  
Proposed source of borrow material.

Notification of encountering rock in the project. Advance notice on the opening of excavation.

## SD-06 Test Reports

Testing; G-AO.

Within 24 hours of conclusion of physical tests, 2 copies of test results, including calibration curves and results of calibration tests.

## SD-07 Certificates

Testing; G-AO.

Qualifications of the commercial testing laboratory or Contractor's testing facilities.

## 1.4 SUBSURFACE DATA

Subsurface soil boring logs are shown on the drawings. These data represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.

## 1.5 CLASSIFICATION OF EXCAVATION

No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation.

## 1.5.1 Rock Excavation

Rock excavation shall include blasting, excavating, grading, and disposing of material classified as rock and shall include the satisfactory removal and disposal of boulders 1/2 cubic yard or more in volume; solid rock; rock material that is in ledges, bedded deposits, and unstratified masses, which cannot be removed without systematic drilling and blasting; and firmly cemented conglomerate deposits possessing the characteristics of solid rock impossible to remove without systematic drilling and blasting. If at any time during excavation, the Contractor encounters material that may be classified as rock excavation, such material shall be uncovered and the Contracting Officer notified by the Contractor. The Contractor shall not proceed with the excavation of this material until the Contracting Officer has classified the materials as common excavation or rock excavation and has taken cross sections as required. Failure on the part of the Contractor to uncover such material, notify the Contracting Officer, and allow ample time for classification and cross sectioning of the undisturbed surface of such material will cause the forfeiture of the Contractor's right of claim to any classification or volume of material to be paid for other than that allowed by the Contracting Officer for the areas of work in which such deposits occur.

## 1.5.2 Common Excavation

Common excavation shall include the satisfactory removal and disposal of all materials not classified as rock excavation.

#### 1.6 BLASTING

Blasting will not be permitted.

#### 1.7 UTILIZATION OF EXCAVATED MATERIALS

Unsatisfactory materials removed from excavations shall be disposed of outside the limits of Government-controlled lands. Satisfactory material removed from excavations shall be used, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. No satisfactory excavated material shall be wasted without specific written authorization. Satisfactory material authorized to be wasted shall be disposed of outside the limits of Government-controlled lands. No excavated material shall be disposed of to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

#### PART 2 PRODUCTS (Not Applicable)

#### PART 3 EXECUTION

##### 3.1 STRIPPING OF TOPSOIL

Topsoil shall be stripped to a depth of 4 inches from areas to be excavated or filled. Topsoil shall be spread on areas already graded and prepared for topsoil, or transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified. Topsoil shall be kept separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 2 inches in diameter, and other materials that would interfere with planting and maintenance operations. Any surplus of topsoil from excavations and grading shall be removed from the site.

##### 3.2 GENERAL EXCAVATION

The Contractor shall perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Grading shall be in conformity with the typical sections shown and the tolerances specified in paragraph FINISHING. Satisfactory excavated materials shall be transported to and placed in fill or embankment within the limits of the work. Unsatisfactory materials encountered within the limits of the work shall be excavated below grade and replaced with satisfactory materials as directed. Such excavated material and the satisfactory material ordered as replacement shall be included in excavation. Surplus satisfactory excavated material not required for fill or embankment shall be disposed of outside the limits of Government-controlled land. During construction, excavation and fill shall be performed in a manner and sequence that will provide proper drainage at all times. Material required for fill or embankment in excess of that produced by excavation within the grading limits shall be excavated from areas outside the limits of Government-controlled land.

###### 3.2.1 Ditches, Gutters, and Channel Changes

Excavation of ditches, gutters, and channel changes shall be accomplished by cutting accurately to the cross sections, grades, and elevations shown. Ditches and gutters shall not be excavated below grades shown. Excessive open ditch or gutter excavation shall be backfilled with satisfactory, thoroughly compacted, material or with suitable stone or cobble to grades shown. The Contractor shall maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

### 3.2.2 Drainage Structures

Excavations shall be made to the lines, grades, and elevations shown, or as directed. Trenches and foundation pits shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Rock or other hard foundation material shall be cleaned of loose debris and cut to a firm, level, stepped, or serrated surface. Loose disintegrated rock and thin strata shall be removed. When concrete or masonry is to be placed in an excavated area, the bottom of the excavation shall not be disturbed. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

### 3.3 SELECTION OF BORROW MATERIAL

Borrow material shall be selected to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Borrow material shall be obtained from approved private sources. Unless otherwise provided in the contract, the Contractor shall obtain from the owners the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling. Unless specifically provided, no borrow shall be obtained within the limits of the project site without prior written approval.

### 3.4 BACKFILL

Backfill adjacent to any and all types of structures shall be placed and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials to prevent wedging action or eccentric loading upon or against the structure. Ground surface on which backfill is to be placed shall be prepared as specified in paragraph PREPARATION OF GROUND SURFACE FOR EMBANKMENTS. Compaction requirements for backfill materials shall also conform to the applicable portions of paragraphs PREPARATION OF GROUND SURFACE FOR EMBANKMENTS, EMBANKMENTS, and SUBGRADE PREPARATION, and Section 02630 STORM-DRAINAGE SYSTEM; and Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

### 3.5 PREPARATION OF GROUND SURFACE FOR EMBANKMENTS

#### 3.5.1 General Requirements

Ground surface on which fill is to be placed shall be stripped of live, dead, or decayed vegetation, rubbish, debris, and other unsatisfactory material; plowed, disked, or otherwise broken up to a depth of 4 inches; pulverized; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless

materials. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. The prepared ground surface shall be scarified and moistened or aerated as required just prior to placement of embankment materials to assure adequate bond between embankment material and the prepared ground surface.

### 3.5.2 Frozen Material

Embankment shall not be placed on a foundation which contains frozen material, or which has been subjected to freeze-thaw action. This prohibition encompasses all foundation types, including the natural ground, all prepared subgrades (whether in an excavation or on an embankment) and all layers of previously placed and compacted earth fill which become the foundations for successive layers of earth fill. All material that freezes or has been subjected to freeze-thaw action during the construction work, or during periods of temporary shutdowns, such as, but not limited to, nights, holidays, weekends, winter shutdowns, or earthwork operations, shall be removed to a depth that is acceptable to the Contracting Officer and replaced with new material. Alternatively, the material will be thawed, dried, reworked, and recompact to the specified criteria before additional material is placed. The Contracting Officer will determine when placement of fill shall cease due to cold weather. The Contracting Officer may elect to use average daily air temperatures, and/or physical observation of the soils for his determination. Embankment material shall not contain frozen clumps of soil, snow, or ice.

## 3.6 EMBANKMENTS

### 3.6.1 Earth Embankments

Earth embankments shall be constructed from satisfactory materials free of organic or frozen material. The material shall be placed in successive horizontal layers of loose material not more than 12 inches in depth. Each layer shall be spread uniformly on a soil surface that has been moistened or aerated as necessary, and scarified or otherwise broken up so that the fill will bond with the surface on which it is placed. After spreading, each layer shall be plowed, disked, or otherwise broken up; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Compaction requirements for the upper 6-inch portion of earth embankments forming subgrade for pavements shall be identical with those requirements specified in paragraph SUBGRADE PREPARATION. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

## 3.7 SUBGRADE PREPARATION

### 3.7.1 Construction

Subgrade shall be shaped to line, grade, and cross section, and compacted as specified. This operation shall include plowing, disking, and any moistening or aerating required to obtain specified compaction. Soft or otherwise unsatisfactory material shall be removed and replaced with satisfactory excavated material or other approved material as directed. Low areas resulting from removal of unsatisfactory material shall be brought up to required grade with satisfactory materials, and the entire subgrade shall be shaped to line, grade, and cross section and compacted as

specified. After rolling, the surface of the subgrade for roadways shall not show deviations greater than 3/8 inch when tested with a 12 foot straightedge applied both parallel and at right angles to the centerline of the area. The elevation of the finish subgrade shall not vary more than 0.05 foot from the established grade and cross section.

### 3.7.2 Compaction

Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

#### 3.7.2.1 Subgrade for Pavements

Subgrade for pavements shall be compacted to at least 95 percentage laboratory maximum density for the depth below the surface of the pavement shown.

### 3.8 SHOULDER CONSTRUCTION

Shoulders shall be constructed of satisfactory excavated or borrow material or as otherwise shown or specified. Shoulders shall be constructed as soon as possible after adjacent paving is complete, but in the case of rigid pavements, shoulders shall not be constructed until permission of the Contracting Officer has been obtained. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Shoulder construction shall be done in proper sequence in such a manner that adjacent ditches will be drained effectively and that no damage of any kind is done to the adjacent completed pavement. The completed shoulders shall be true to alignment and grade and shaped to drain in conformity with the cross section shown.

### 3.9 FINISHING

The surface of excavations, embankments, and subgrades shall be finished to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. The degree of finish for graded areas shall be within 0.1 foot of the grades and elevations indicated except that the degree of finish for subgrades shall be specified in paragraph SUBGRADE PREPARATION. Gutters and ditches shall be finished in a manner that will result in effective drainage. The surface of areas to be turfed shall be finished to a smoothness suitable for the application of turfing materials.

### 3.10 PLACING TOPSOIL

On areas to receive topsoil, the compacted subgrade soil shall be scarified to a 2 inch depth for bonding of topsoil with subsoil. Topsoil then shall be spread evenly to a minimum thickness of 4 inches and graded to the elevations and slopes shown. Topsoil shall not be spread when frozen or excessively wet or dry. Material required for topsoil in excess of that produced by excavation within the grading limits shall be obtained from offsite areas. Topsoil shall be compacted to approximately 80 percent laboratory maximum density.

### 3.11 TESTING

Testing shall be performed by an approved commercial testing laboratory or

by the Contractor subject to approval. If the Contractor elects to establish testing facilities, no work requiring testing will be permitted until the Contractor's facilities have been inspected and approved by the Contracting Officer. Field in-place density shall be determined in accordance with ASTM D 1556, ASTM D 2167 or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted using only the sand cone method as described in ASTM D 1556. ASTM D 2922 results in a wet unit weight of soil and when using this method ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017; the calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer. When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, the material shall be removed, replaced and recompacted to meet specification requirements. Tests on recompacted areas shall be performed to determine conformance with specification requirements. Inspections and test results shall be certified by a registered professional civil engineer. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

#### 3.11.1 In-Place Densities

- a. One test per 30,000 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by other than hand-operated machines.
- b. One test per 20,000 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by hand-operated machines.
- c. One test per 10,000 linear feet, or fraction thereof, of each lift of embankment or backfill for roads.

#### 3.11.2 Check Tests on In-Place Densities

If ASTM D 2922 is used, in-place densities shall be checked by ASTM D 1556 as follows:

- a. One check test per lift for each 300,000 square feet, or fraction thereof, of each lift of fill or backfill compacted by other than hand-operated machines.
- b. One check test per lift for each 200,000 square feet, or fraction thereof, of fill or backfill areas compacted by hand-operated machines.
- c. One check test per lift for each 100,000 square feet, or fraction thereof, of embankment or backfill for roads.

#### 3.11.3 Moisture Contents

In the stockpile, excavation, or borrow areas, a minimum of two tests per day per type of material or source of material being placed during stable weather conditions shall be performed. During unstable weather, tests shall be made as dictated by local conditions and approved by the

Contracting Officer.

#### 3.11.4 Optimum Moisture and Laboratory Maximum Density

Tests shall be made for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 2500 cubic yards of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

#### 3.11.5 Tolerance Tests for Subgrades

Continuous checks on the degree of finish specified in paragraph SUBGRADE PREPARATION shall be made during construction of the subgrades.

#### 3.12 SUBGRADE AND EMBANKMENT PROTECTION

During construction, embankments and excavations shall be kept shaped and drained. Ditches and drains along subgrade shall be maintained to drain effectively at all times. The finished subgrade shall not be disturbed by traffic or other operation and shall be protected and maintained by the Contractor in a satisfactory condition until ballast, subbase, base, or pavement is placed. The storage or stockpiling of materials on the finished subgrade will not be permitted. No subbase, base course, or pavement shall be laid until the subgrade has been checked and approved, and in no case shall subbase, base, surfacing or pavement be placed on a muddy, spongy, or frozen subgrade.

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SECTION 02315A

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08/98

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## SECTION 02315A

EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS  
08/98

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1556	(1990; R 1996e1) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991; R 1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2216	(1998) Laboratory Determination of Water (Moisture) Content of Soil and Rock
ASTM D 2487	(1998) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1996e1) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 2937	(1994) Density of Soil in Place by the Drive-Cylinder Method
ASTM D 3017	(1988; R 1996e1) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(1998) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

## 1.2 DEGREE OF COMPACTION

Degree of compaction is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557, abbreviated as percent laboratory maximum density.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### SD-06 Test Reports

##### Testing; G-AO

Copies of all laboratory and field test reports within 24 hours of the completion of the test.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Satisfactory Materials

Satisfactory materials shall comprise any materials classified by ASTM D 2487 as GW, GP, GC, GM, SW, SP, SC, SM, and ML.

#### 2.1.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include expansive soils (CH), man-made fills, trash, refuse, or backfills from previous construction. Unsatisfactory material also includes material classified as satisfactory which contains root and other organic matter, frozen material, and stones larger than 3 inches. The Contracting Officer shall be notified of any contaminated materials.

#### 2.1.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM shall be identified as cohesionless only when the fines are nonplastic.

#### 2.1.4 Expansive Soils

Expansive soils are defined as soils that have a plasticity index equal to or greater than 24 when tested in accordance with ASTM D 4318.

### 2.2 CAPILLARY WATER BARRIER

Capillary Water Barrier shall consist of clean, crushed, nonporous rock, crushed gravel, or uncrushed gravel. The maximum particle size shall be 1-1/2 inches and no more than 2 percent by weight shall pass the No. 4 size sieve.

### 2.3 Select Fill

Select fill shall consist of crushed stone, gravel, sand, or other approved aggregates, processed and blended or naturally combined. Select fill shall be durable and sound, free from lumps and balls of clay, organic matter, objectionable coatings or other foreign matter. Material retained on the No. 4 sieve shall have a percentage of wear not to exceed 50 percent after 500 revolutions when tested in accordance with ASTM C 131. Material retained on the No. 4 sieve shall not exhibit a loss greater than 18 percent weighted average, at five cycles, when tested for soundness in magnesium sulfate in accordance with ASTM C 88. Aggregate shall be reasonably uniform in density and quality. Aggregates shall meet the maximum particle size and gradation limits shown below:

Beneath footings and more than 8-inches below Geomembrane:  
Maximum particle size = 1 1/2 inches

Square-Mesh Sieve Sieve Designation	Max. % by Weight Passing
2"	100
1 1/2"	90-100
No. 4	0-15
No. 200	0- 5

The following Montana Department of Transportation Aggregate No. 1, No. 2, No. 3 and No. 4 of Table 701-4 TABLE OF GRADATIONS - COARSE AGGREGATE FOR CONCRETE meets the above criteria except within 8-inches of the vapor barrier. Note Nos. 1,2,3, and 4 corresponds to AASHTO/ASTM designations 467, 67, 4, and 7 respectively.

The following Montana Department of Transportation Aggregate TABLE 701-18 TABLE OF GRADATION - FILTER MATERIAL - Gradation No. 2 meets the Select Fill requirement except within 8-inches of a vapor barrier.

Within 8-inches below Geomembrane vapor barrier:  
Maximum particle size = 3/8 inches

Square-Mesh Sieve Sieve Designation	Max. % by Weight Passing
3/8"	100
No. 4	0-100
No. 200	0- 5

The following Montana Department of Transportation Aggregate Grade 4A and Grade 5A of Table 701-12 TABLE OF GRADATIONS-COVER MATERIAL also meets the requirements of Select fill with in 8 inches of the vapor barrier

and

The following Montana Department of Transportation Aggregate Table 701-2 TABLE OF GRADATION - FINE AGGREGATE FOR CONCRETE

The portion of any blended component and of the completed course passing the No. 40 sieve shall be either nonplastic or shall have a liquid limit not greater than 25 and a plasticity index not greater than 5. Compaction of select fill shall be according to ASTM D 1557.

### PART 3 EXECUTION

### 3.1 CLEARING AND GRUBBING

The areas within lines 5 feet outside of each building and structure line shall be cleared and grubbed of trees, stumps, roots, brush and other vegetation, debris, existing foundations, pavements, utility lines, structures, fences, and other items that would interfere with construction operations. Stumps, logs, roots, and other organic matter shall be completely removed and the resulting depressions shall be filled with satisfactory material, placed and compacted in accordance with paragraph FILLING AND BACKFILLING. Materials removed shall be disposed of outside the limits of Government-controlled property at the Contractor's responsibility.

### 3.2 TOPSOIL

Topsoil shall be stripped within the designated excavations and grading lines and deposited in storage piles for later use as specified in Section 02300A EARTHWORK. Excess topsoil shall be disposed as specified for excess excavated material.

### 3.3 EXCAVATION

See the drawings for overexcavation requirements below footings and slabs. Excavation shall conform to the dimensions and elevations indicated for each building, structure, and footing except as specified, and shall include trenching for utility and foundation drainage systems to a point 5 feet beyond the building line of each building and structure, excavation for and all work incidental thereof. Excavation shall extend a sufficient distance from walls and footings to allow for placing and removal of forms.

Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material encountered below the grades shown shall be replaced with satisfactory material; and payment will be made in conformance with the CHANGES clause of the CONTRACT CLAUSES. Satisfactory material removed below the depths indicated, without specific direction of the Contracting Officer, shall be replaced, at no additional cost to the Government, with satisfactory materials to the indicated excavation grade; except that concrete footings shall be increased in thickness to the bottom of the overdepth excavations and over-break in rock excavation. Satisfactory material shall be placed and compacted as specified in paragraph FILLING AND BACKFILLING. Determination of elevations and measurements of approved overdepth excavation of unsatisfactory material below grades indicated shall be done under the direction of the Contracting Officer.

### 3.4 DRAINAGE AND DEWATERING

#### 3.4.1 Drainage

Surface water shall be directed away from excavation and construction sites to prevent erosion and undermining of foundations. Diversion ditches, dikes and grading shall be provided and maintained as necessary during construction. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site, the area immediately surrounding the site, and the area affecting operations at the site shall be continually and effectively drained.

#### 3.4.2 Dewatering

Groundwater flowing toward or into excavations shall be controlled to

prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, the water level shall be maintained continuously, at least 2 feet below the working level.

### 3.5 SHORING

Shoring, including sheet piling, shall be furnished and installed as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Shoring, bracing, and sheeting shall be removed as excavations are backfilled, in a manner to prevent caving.

### 3.6 CLASSIFICATION OF EXCAVATION

Excavation will be unclassified regardless of the nature of material encountered.

### 3.7 BLASTING

Blasting will not be permitted.

### 3.8 UTILITY AND DRAIN TRENCHES

Trenches for underground utilities systems and drain lines shall be excavated as specified in Section 02316a EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITY SYSTEM .

### 3.9 BORROW

Where satisfactory materials are not available in sufficient quantity from required excavations, approved materials shall be obtained as specified in Section 02300 EARTHWORK.

### 3.10 EXCAVATED MATERIALS

Satisfactory excavated material required for fill or backfill shall be placed in the proper section of the permanent work required under this section or shall be separately stockpiled if it cannot be readily placed. Satisfactory material in excess of that required for the permanent work and all unsatisfactory material shall be disposed of as specified in Section 02300 EARTHWORK.

### 3.11 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Excavation to final grade shall not be made until just before concrete is to be placed. Approximately level surfaces shall be roughened, and sloped surfaces shall be cut as indicated into rough steps or benches to provide a satisfactory bond. All surfaces shall be protected from erosion resulting from ponding or flow of water.

### 3.12 SUBGRADE PREPARATION

Unsatisfactory material in surfaces to receive fill or in excavated areas

shall be removed and replaced with satisfactory materials as directed by the Contracting Officer. The surface shall be scarified to a depth of 6 inches before the fill is started. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 6 inches, pulverized, and compacted to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches and compacted as specified for the adjacent fill. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Minimum subgrade density shall be as specified in paragraph FILLING AND BACKFILLING.

3.13 FILLING AND BACKFILLING

See the drawings for overexcavation requirements below footings and slabs. Satisfactory materials shall be used in bringing fills and backfills to the lines and grades indicated and for replacing unsatisfactory materials. Satisfactory materials shall be placed in horizontal layers not exceeding 8 inches in loose thickness, or 6 inches when hand-operated compactors are used. After placing, each layer shall be plowed, disked, or otherwise broken up, moistened or aerated as necessary, thoroughly mixed and compacted as specified. Backfilling shall not begin until construction below finish grade has been approved, underground utilities systems have been inspected, tested and approved, forms removed, and the excavation cleaned of trash and debris. Backfill shall be brought to indicated finish grade. Backfill shall not be placed in wet or frozen areas. Where pipe is coated or wrapped for protection against corrosion, the backfill material up to an elevation 2 feet above sewer lines and 1 foot above other utility lines shall be free from stones larger than 1 inch in any dimension. Heavy equipment for spreading and compacting backfill shall not be operated closer to foundation or retaining walls than a distance equal to the height of backfill above the top of footing; the area remaining shall be compacted in layers not more than 4 inches in compacted thickness with power-driven hand tampers suitable for the material being compacted. Backfill shall be placed carefully around pipes or tanks to avoid damage to coatings, wrappings, or tanks. Backfill shall not be placed against foundation walls prior to 7 days after completion of the walls. As far as practicable, backfill shall be brought up evenly on each side of the wall and sloped to drain away from the wall. Each layer of fill and backfill shall be compacted to not less than the percentage of maximum density specified below:

Percent Laboratory  
maximum density

---

Cohesive  
material

---

Cohesionless  
material

---

Fill, embankment, and backfill

---

	Percent Laboratory maximum density	
	Cohesive material	Cohesionless material
Under structures, building slabs, steps, paved areas, around footings, and in trenches	90	95
Under sidewalks and grassed areas	90	95
<u>Subgrade</u>		
Under building slabs, steps, and paved areas, top 12 inches	90	95
Under sidewalks, top 6 inches	90	95

Approved compacted subgrades that are disturbed by the Contractor's operations or adverse weather shall be scarified and compacted as specified herein before to the required density prior to further construction thereon. Recomaction over underground utilities and heating lines shall be by hand tamping.

3.14 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or may be performed by the Contractor subject to approval. Field in-place density shall be determined in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted if necessary by the procedure described in ASTM D 2922, paragraph ADJUSTING CALIBRATION CURVE. ASTM D 2922 results in a wet unit weight of soil and when using this method ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer. ASTM D 2937 shall be used only for soft, fine-grained, cohesive soils. The following number of tests, if performed at the appropriate time, shall be the minimum acceptable for each type operation.

3.14.1 In-Place Densities

In-place density and moisture content test results shall be included with the Contractor's daily construction quality control reports.

3.14.1.1 In-Place Density of Subgrades

One test per 1000 square foot or fraction thereof.

### 3.14.1.2 In-Place Density of Fills and Backfills

One test per 3000 square foot or fraction thereof of each lift for fill or backfill areas compacted by other than hand or hand-operated machines. The density for each lift of fill or backfill materials for trenches, pits, building perimeters or other structures or areas less than 3 feet in width, which are compacted with hand or hand-operated machines shall be tested as follows: One test per each area less than 500 square feet, or one test for each 100 linear foot of long narrow fills. If ASTM D 2922 is used, in-place densities shall be checked by ASTM D 1556 at least twice daily.

### 3.14.2 Moisture Content

In the stockpile, excavation or borrow areas, a minimum of two tests per day per type of material or source of materials being placed is required during stable weather conditions. During unstable weather, tests shall be made as dictated by local conditions and approved moisture content shall be tested in accordance with ASTM D 2216.

### 3.14.3 Optimum Moisture and Laboratory Maximum Density

Tests shall be made for each type material or source of material, including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 100 cubic yards of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density will be made.

### 3.15 CAPILLARY WATER BARRIER

Capillary water barrier under concrete floor and area-way slabs on grade shall be placed on a geomembrane and geotextile as shown on the drawings and shall be compacted with a minimum of two passes of a hand-operated plate-type vibratory compactor.

### 3.16 GRADING

Areas within 5 feet outside of each building and structure line shall be constructed true-to-grade, shaped to drain, and shall be maintained free of trash and debris until final inspection has been completed and the work has been accepted.

### 3.17 PROTECTION

Settlement or washing that occurs in graded, topsoiled, or backfilled areas prior to acceptance of the work, shall be repaired and grades reestablished to the required elevations and slopes.

-- End of Section --

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EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS

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## SECTION 02316A

EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS  
11/97

## PART 1 GENERAL

This guide specification covers the requirements for excavation, trenching, and backfilling for utilities systems to the points of connection within 5 feet of buildings only.

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1556	(1990; R 1996) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2487	(1998) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1996) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R1996e1) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

## 1.2 DEGREE OF COMPACTION

Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Field Density Tests; G-AO  
Testing of Backfill Materials; G-AO

Copies of all laboratory and field test reports within 24 hours  
of the completion of the test.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Satisfactory Materials

Satisfactory materials shall comprise any materials classified by ASTM D 2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP, SM, SW-SM, SC, SW-SC, SP-SM, SP-SC, CL, ML, and CL-ML. Infiltration gallery engineered material shall be as defined in section 02620a "Infiltration Gallery Filter Bed."

#### 2.1.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills, trash, refuse, or backfills from previous construction. Unsatisfactory material also includes material classified as satisfactory which contains root and other organic matter, frozen material, and stones larger than 3 inches. The Contracting Officer shall be notified of any contaminated materials.

#### 2.1.3 Cohesionless and Cohesive Materials

Cohesionless materials shall include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials shall include materials classified as GC, SC, ML, and CL. Materials classified as GM and SM shall be identified as cohesionless only when the fines are nonplastic.

#### 2.1.4 Unyielding Material

Unyielding material shall consist of rock and gravelly soils with stones greater than 3 inches in any dimension or as defined by the pipe manufacturer, whichever is smaller.

#### 2.1.5 Unstable Material

Unstable material shall consist of materials too wet to properly support the utility pipe, conduit, or appurtenant structure.

#### 2.1.6 Select Granular Material

Select granular material shall consist of well-graded sand, gravel, crushed gravel, crushed stone or crushed slag composed of hard, tough and durable particles, and shall contain not more than 10 percent by weight of material passing a No. 200 mesh sieve and no less than 95 percent by weight passing the 1 inch sieve. The maximum allowable aggregate size shall be 1 inch, or the maximum size recommended by the pipe manufacturer, whichever is smaller.

#### 2.1.7 Initial Backfill Material

Initial backfill shall consist of select granular material or satisfactory materials free from rocks lynch or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller. When the pipe is coated or wrapped for corrosion protection, the initial backfill material shall be free of stones larger than 0.5 inches in any dimension or as recommended by the pipe manufacturer, whichever is smaller.

## 2.2 PLASTIC MARKING TAPE

Plastic marking tape shall be acid and alkali-resistant polyethylene film, 6 inches wide with minimum thickness of 0.004 inch. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be as specified in TABLE 1 and shall bear a continuous printed inscription describing the specific utility.

TABLE 1. Tape Color

Red:	Electric
Yellow:	Gas, Oil, Dangerous Materials
Orange:	Telephone,
Blue:	Water Systems
Green:	Sewer Systems

## PART 3 EXECUTION

### 3.1 EXCAVATION

Excavation shall be performed to the lines and grades indicated. Rock excavation shall include removal and disposition of material defined as rock in paragraph MATERIALS. Earth excavation shall include removal and disposal of material not classified as rock excavation. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench equal to 1/2 the depth of the excavation, but in no instance closer than 2 feet. Excavated material not required or not satisfactory for backfill shall be removed from the site.

Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating shall be removed to maintain the stability of the bottom and sides of the excavation. Dewatering shall be as required to accomplish the task. If dewatering is required, the Contractor shall submit a dewatering plan as defined in Section 02315A. Unauthorized overexcavation shall be backfilled in accordance with paragraph BACKFILLING AND COMPACTION at no additional cost to the Government.

#### 3.1.1 Trench Excavation Requirements

The trench shall be excavated as recommended by the manufacturer of the pipe to be installed. Trench walls below the top of the pipe shall be sloped, or made vertical, and of such width as recommended in the manufacturer's installation manual. Where no manufacturer's installation manual is available, trench walls shall be made vertical. Trench walls more than 4 feet high shall be shored, cut back to a stable slope, or provided with equivalent means of protection for employees who may be

exposed to moving ground or cave in. Vertical trench walls more than feet high shall be shored. Trench walls which are cut back shall be excavated to at least the angle of repose of the soil. Special attention shall be given to slopes which may be adversely affected by weather or moisture content. The trench width below the top of pipe shall not exceed 24 inches plus pipe outside diameter (O.D.) for pipes of less than 24 inches inside diameter and shall not exceed 36 inches plus pipe outside diameter for sizes larger than 24 inches inside diameter. Where recommended trench widths are exceeded, redesign, stronger pipe, or special installation procedures shall be utilized by the Contractor. The cost of redesign, stronger pipe, or special installation procedures shall be borne by the Contractor without any additional cost to the Government.

#### 3.1.1.1 Bottom Preparation

The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 3 inches or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.

#### 3.1.1.2 Removal of Unyielding Material

Where overdepth is not indicated and unyielding material is encountered in the bottom of the trench, such material shall be removed 4 inches below the required grade and replaced with suitable materials as provided in paragraph BACKFILLING AND COMPACTION.

#### 3.1.1.3 Excavation for Appurtenances

Excavation for structures shall be sufficient to leave at least 12 inches clear between the outer structure surfaces and the face of the excavation or support members of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Removal of unstable material shall be as specified above. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

#### 3.1.1.4 Jacking, Boring, and Tunneling

Unless otherwise indicated, excavation shall be by open cut except that sections of a trench may be jacked, bored, or tunneled if, in the opinion of the Contracting Officer, the pipe, cable, or duct can be safely and properly installed and backfill can be properly compacted in such sections.

#### 3.1.2 Stockpiles

Stockpiles of satisfactory and unsatisfactory and wasted materials shall be placed and graded as specified. Stockpiles shall be kept in a neat and well drained condition, giving due consideration to drainage at all times. The ground surface at stockpile locations shall be cleared, grubbed, and sealed by rubber-tired equipment, excavated satisfactory and unsatisfactory materials shall be separately stockpiled. Stockpiles of satisfactory materials shall be protected from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, such

material shall be removed and replaced with satisfactory material from approved sources at no additional cost to the Government. Locations of stockpiles of satisfactory materials shall be subject to prior approval of the Contracting Officer.

### 3.2 BACKFILLING AND COMPACTION

Backfill material shall consist of satisfactory material, select granular material, or initial backfill material as required. Backfill shall be placed in layers not exceeding 6 inches loose thickness for compaction by hand operated machine compactors, and 8 inches loose thickness for other than hand operated machines, unless otherwise specified. Each layer shall be compacted to at least 95 percent maximum density for cohesionless soils and 90 percent maximum density for cohesive soils, unless otherwise specified.

#### 3.2.1 Trench Backfill

Trenches shall be backfilled to the grade shown.

##### 3.2.1.1 Replacement of Unyielding Material

Unyielding material removed from the bottom of the trench shall be replaced with select granular material or initial backfill material.

##### 3.2.1.2 Replacement of Unstable Material

Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 6 inches loose thickness.

##### 3.2.1.3 Bedding and Initial Backfill

Initial backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the utility pipe or conduit.

The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe.

##### 3.2.1.4 Final Backfill

The remainder of the trench, except for special materials for roadways shall be filled with satisfactory material. Backfill material shall be placed and compacted as follows:

- a. Sidewalks, Turfed or Seeded Areas and Miscellaneous Areas:  
Backfill shall be deposited in layers of a maximum of 12 inch loose thickness, and compacted to 90 percent maximum density for cohesive soils and 95 percent maximum density for cohesionless soils. This requirement shall also apply to all other areas not specifically designated above.

#### 3.2.2 Backfill for Appurtenances

After the structure has been constructed and the concrete has been allowed to cure for 7 days, backfill shall be placed in such a manner that the structure will not be damaged by the shock of falling earth. The backfill material shall be deposited and compacted as specified for final backfill, and shall be brought up evenly on all sides of the structure to prevent

eccentric loading and excessive stress.

### 3.3 Engineered Fill Placement

The Contractor shall develop a workplan to be submitted for Corps approval no less than three weeks prior to proposed construction activity within the dredge cut area. The Contractor shall outline his proposed installation method for the infiltration gallery and raw water intake piping, all conveyance piping, air backwash and schumasoil (or engineer equal) piping, as well as the projected transition element/penetration detail into the pumphouse.

The workplan shall detail all safety precautions to be taken as part of the work effort as well as all special tools and equipment to be required for the construction effort.

If the Contractor requires diving services as part of his quality control or installation process, all diving activities shall conform with section 01080 of this contract.

Piping material shall be as defined in section 15200a.

### 3.4 SPECIAL REQUIREMENTS

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

#### 3.4.1 Gas Distribution

Trenches shall be excavated to a depth that will provide not less than 18 inches of cover in rock excavation and not less than 24 inches of cover in other excavation.

#### 3.4.2 Water Lines

Trenches shall be of a depth to provide a minimum cover of 7.5 feet from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe.

#### 3.4.3 Electrical Distribution System

Direct burial cable and conduit or duct line shall have a minimum cover of 24 inches from the finished grade, unless otherwise indicated. Special trenching requirements for direct-burial electrical cables and conduits are specified in Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

#### 3.4.4 Plastic Marking Tape

Warning tapes shall be installed directly above the pipe, at a depth of 18 inches below finished grade unless otherwise shown.

### 3.5 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government.

#### 3.5.1 Testing Facilities

Tests shall be performed by an approved commercial testing laboratory or

may be tested by facilities furnished by the Contractor. No work requiring testing will be permitted until the facilities have been inspected and approved by the Contracting Officer.

### 3.5.2 Testing of Backfill Materials

Classification of backfill materials shall be determined in accordance with ASTM D 2487 and the moisture-density relations of soils shall be determined in accordance with ASTM D 1557. A minimum of one soil classification and one moisture-density relation test shall be performed on each different type of material used for bedding and backfill.

### 3.5.3 Field Density Tests

Tests shall be performed in sufficient numbers to ensure that the specified density is being obtained. A minimum of one field density test per lift of backfill for every 100 feet of installation shall be performed. One moisture density relationship shall be determined for every 1500 cubic yards of material used. Field in-place density shall be determined in accordance with ASTM D 1556 ASTM D 2167 ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted using the sand cone method as described in paragraph Calibration of the ASTM publication. ASTM D 2922 results in a wet unit weight of soil and when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job, on each different type of material encountered, at intervals as directed by the Contracting Officer. Copies of calibration curves, results of calibration tests, and field and laboratory density tests shall be furnished to the Contracting Officer. Trenches improperly compacted shall be reopened to the depth directed, then refilled and compacted to the density specified at no additional cost to the Government.

### 3.5.4 Displacement of Piping

After other required tests have been performed and the trench backfill compacted to 2 feet above the top of the pipe, the pipe shall be inspected to determine whether significant displacement has occurred. This inspection shall be conducted in the presence of the Contracting Officer.

If, in the judgement of the Contracting Officer, the interior of the pipe shows poor alignment or any other defects that would cause improper functioning of the system, the defects shall be remedied as directed at no additional cost to the Government.

-- End of Section --

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## SECTION 02370A

## GEOMEMBRANE FOR PONDS

10/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of the specification to the extent referenced. The publications are referenced in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 638	(1999) Tensile Properties of Plastics
ASTM D 1004	(1994a) Initial Tear Resistance of Plastic Film and Sheeting
ASTM D 1505	(1998) Density of Plastics by the Density-Gradient Technique
ASTM D 1603	(1994) Carbon Black in Olefin Plastics
ASTM D 3895	(1998) Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
ASTM D 4218	(1996) Test Method for Determination of Carbon Black Content in Polyethylene Compounds By the Muffle-Furnace Technique
ASTM D 4833	(2000) Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM D 5199	(1999) Measuring Nominal Thickness of Geotextiles and Geomembranes
ASTM D 5397	(1995) Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
ASTM D 5596	(1994) Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
ASTM D 5721	(1995) Air-Oven Aging of Polyolefin Geomembranes
ASTM D 5885	(1997) Oxidative Induction Time of Polyolefin Geosynthetics by High-Pressure Differential Scanning Calorimetry
ASTM D 6392	(1999) Determining the Integrity of

Nonreinforced Geomembrane Seams Produced  
Using Thermo-Fusion Methods

ASTM D 6497

(2000) Mechanical Attachment of  
Geomembrane to Penetrations or Structures

GEOSYNTHETIC INSTITUTE (GSI)

GSI GRI GM-9

(1995) Cold Weather Seaming of Geomembranes

GSI GRI GM-11

(1997) Accelerated Weathering of  
Geomembrane Using a Fluorescent UVA Device

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Layout and Detail Drawings; G-DO

Geomembrane panel layout and penetration detail drawings, a minimum of 7 days prior to geomembrane placement. Also include proposed method and location for attaching geomembrane to concrete chimney structures.

As-Built Drawings; G-AO

Final as-built drawings of geomembrane installation

## SD-03 Product Data

Tests, Inspections, and Verifications; G-AO

Manufacturer's QC manuals, a minimum of 7 days prior to geomembrane shipment.

Field Seaming; G-AO

Installer's QC manual, a minimum of 7 days prior to geomembrane placement.

Qualifications; G-AO

Manufacturer's qualification statements, including resumes of key personnel involved in the project, a minimum of 7 days prior to geomembrane shipment.

Installer's, QC inspector's, and QC laboratory's qualification statements including resumes of key personnel involved in the project a minimum of 7 days prior to geomembrane placement. The submittal from the QC laboratory shall include verification that the laboratory is accredited via the Geosynthetic Accreditation Institute's Laboratory Accreditation Program (GAI-LAP) for the tests the QC laboratory will be required to perform.

## SD-04 Samples

Samples; G-AO

Geomembrane QA and QC samples.

## SD-06 Test Reports

Material; G-AO

Manufacturer's certified raw and sheet material test reports and a copy of the QC certificates, a minimum of 7 days prior to shipment of geomembrane to the site.

Surface Preparation; G-AO

Certification from the QC inspector and installer of the acceptability of the surface on which the geomembrane is to be placed, immediately prior to geomembrane placement.

Non-Destructive Field Seam Continuity Testing; G-AO

QC inspector certified test results on all field seams.

Destructive Field Seam Testing; G-AO

Installer and certified QC laboratory test results on all destructively tested field seams.

Destructive Seam Test Repairs; G-AO

QC inspector certified test results on all repaired seams.

Tests; G-AO

Certified QC test results.

## 1.3 QUALIFICATIONS

## 1.3.1 Manufacturer

Manufacturer shall have produced the proposed geomembrane sheets for at least 5 completed projects having a total minimum area of 10 million square feet.

## 1.3.2 Installer

The installer is responsible for field handling, deploying, seaming, anchoring, and field Quality Control (QC) testing of the geomembrane. The installer shall have installed the proposed geomembrane material for at least 5 completed projects having a total minimum area of 2 million square feet. At least one seamer shall have experience seaming a minimum of 500,000 square feet of the proposed geomembrane using the same type of seaming equipment and geomembrane thickness specified for this project.

## 1.3.3 QC Inspector

The QC inspector is the person or corporation hired by the Contractor, who

is responsible for monitoring and documenting activities related to the QC of the geomembrane from manufacturing through installation. The QC inspector shall have provided QC inspection during installation of the proposed geomembrane material for at least 5 completed projects having a total minimum area of 2 million square feet.

#### 1.3.4 QC Laboratory

The QC laboratory shall have provided QC and/or Quality Assurance (QA) testing of the proposed geomembrane and geomembrane seams for at least five completed projects having a total minimum area of 2 million square feet. The QC laboratory shall be accredited via the Geosynthetic Accreditation Institute's Laboratory Accreditation Program (GAI-LAP) for the tests the QC laboratory will be required to perform.

### 1.4 DELIVERY, STORAGE AND HANDLING

#### 1.4.1 Delivery

The QC inspector shall be present during delivery and unloading of the geomembrane. Each geomembrane roll/panel shall be labeled with the manufacturer's name, product identification number, roll/panel number, and roll dimensions.

#### 1.4.2 Storage

Temporary storage at the project site shall be on a level surface, free of sharp objects where water cannot accumulate. The geomembrane shall be protected from puncture, abrasion, excessive heat or cold, material degradation, or other damaging circumstances. Storage shall not result in crushing the core of roll goods or flattening of the rolls. Rolls shall not be stored more than two high. Palletted materials shall be stored on level surfaces and shall not be stacked on top of one another. Damaged geomembrane shall be removed from the site and replaced with geomembrane that meets the specified requirements.

#### 1.4.3 Handling

Rolls/panels shall not be dragged, lifted by one end, or dropped. A pipe or solid bar, of sufficient strength to support the full weight of a roll without significant bending, shall be used for all handling activities. The diameter of the pipe or solid bar shall be small enough to be easily inserted through the core of the roll. Chains shall be used to link the ends of the pipe or bar to the ends of a spreader bar. The spreader bar shall be wide enough to prevent the chains from rubbing against the ends of the roll. Alternatively, a stinger bar protruding from the end of a forklift or other equipment may be used. The stinger bar shall be at least three-fourths the length of the core and also must be capable of supporting the full weight of the roll without significant bending. If recommended by the manufacturer, a sling handling method utilizing appropriate loading straps may be used.

### 1.5 WEATHER LIMITATIONS

Geomembrane shall not be deployed or field-seamed in the presence of excess moisture (i.e., rain, fog, dew), in areas of ponded water, or in the presence of excess wind. Unless authorized by the Contracting Officer, no placement or seaming shall be attempted at ambient temperatures below 32 degrees F or above 104 degrees F. Ambient temperature shall be measured at

a height no greater than 6 inches above the ground or geomembrane surface. If seaming is allowed below 32 degrees F, the procedures outlined in GSI GRI GM-9 shall be followed. In marginal conditions, seaming shall cease unless destructive field seam tests, conducted by the QC laboratory, confirm that seam properties meet the requirements listed in Table 2. Tests shall be conducted in accordance with paragraph Destructive Field Seam Testing.

## 1.6 EQUIPMENT

Equipment used in performance of the work shall be in accordance with the geomembrane manufacturer's recommendations and shall be maintained in satisfactory working condition.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Raw Materials

Resin used in manufacturing geomembrane sheets shall be made of virgin uncontaminated ingredients. No more than 10 percent regrind, reworked, or trim material in the form of chips or edge strips shall be used to manufacture the geomembrane sheets. All regrind, reworked, or trim materials shall be from the same manufacturer and exactly the same formulation as the geomembrane sheet being produced. No post consumer materials or water-soluble ingredients shall be used to produce the geomembrane. For geomembranes with plasticizers, only primary plasticizers that are resistant to migration shall be used. The Contractor shall submit a copy of the test reports and QC certificates for materials used in the manufacturing of the geomembrane shipped to the site.

#### 2.1.2 Sheet Materials

Geomembrane sheets shall be unreinforced and manufactured as wide as possible to minimize field seams. Geomembrane sheets shall be uniform in color, thickness, and surface texture. The sheets shall be free of and resistant to fungal or bacterial attack and free of cuts, abrasions, holes, blisters, contaminants and other imperfections. Geomembrane sheets shall conform to the requirements listed in Table 1 for Manufacturing Quality Control (MQC).

TABLE 1. SMOOTH HDPE GEOMEMBRANE PROPERTIES

PROPERTY	TEST VALUE	MQC TESTING FREQUENCY (MIN.)	TEST METHOD
Thickness (min ave)	40 mils	per roll	ASTM D 5199
Lowest individual of 10 values	-10 percent	per roll	ASTM D 5199
Density (min)	0.940 g/cc	per 200,000 lb	ASTM D 1505

TABLE 1. SMOOTH HDPE GEOMEMBRANE PROPERTIES

PROPERTY	TEST VALUE	MQC TESTING FREQUENCY (MIN.)	TEST METHOD
Tensile Properties (1) (min ave)		per 20,000 lb	ASTM D 638 Type IV
-yield stress	84 lb/in		
-break stress	152 lb/in		
-yield elong	12 percent		
-break elong	700 percent		
Tear Resistance (min ave)	28 lb	per 45,000 lb	ASTM D 1004
Puncture Resistance (min ave)	72 lb	per 45,000 lb	ASTM D 4833
Stress Crack Resistance (2)	200 hr	per 200,000 lb	ASTM D 5397 (Appendix)
Carbon Black Content	2.0-3.0 percent	per 20,000 lb	ASTM D 1603 (3)
Carbon Black Dispersion	Note (4)	per 45,000 lb	ASTM D 5596
Oxidative Induction Time (OIT) (min ave) (5)		per 200,000 lb	
-Std OIT	100 min		ASTM D 3895
or			
-High Pres OIT	400 min		ASTM D 5885
Oven Aging at 85 deg C (min ave) (5), (6)		per year and change in formulation	ASTM D 5721
-Std OIT	55 percent at 90 days		ASTM D 3895
or			
-High Pres OIT	80 percent at 90 days		ASTM D 5885
UV Resistance (min ave) (7)		per year and change in formulation	GSI GRI GM-11
-High Pres OIT(8)(9)	50 percent		ASTM D 5885

TABLE 1. SMOOTH HDPE GEOMEMBRANE PROPERTIES

PROPERTY	TEST VALUE	MQC TESTING FREQUENCY (MIN.)	TEST METHOD
	at 1600 hours		

MQC = Manufacturing Quality Control

Note (1): Minimum average machine direction and minimum average cross machine direction values shall be based on 5 test specimens in each direction. For HDPE geomembrane, yield elongation is calculated using a gauge length of 1.3 inches. For HDPE geomembrane, break elongation is calculated using a gauge length of 2.0 inches.

Note (2): For HDPE geomembrane, the yield stress used to calculate the applied load for test method ASTM D 5397 (Appendix), shall be the manufacturer's mean value.

Note (3): Other methods such as ASTM D 4218 or microwave methods are acceptable if an appropriate correlation to ASTM D 1603 can be established.

Note (4): Carbon black dispersion for 10 different views:  
 - minimum 8 of 10 in Categories 1 or 2  
 - all 10 in Categories 1,2, or 3

Note (5): The manufacturer has the option to select either one of the OIT methods to evaluate the antioxidant content.

Note (6): Evaluate samples at 30 and 60 days and compare with the 90 day response.

Note (7): The condition of the test shall be a 20 hour UV cycle at 167 degrees F followed by a 4 hour condensation cycle at 140 degrees F.

Note (8): The standard OIT test (ASTM D3895) shall not be used in determining UV resistance.

Note (9): UV resistance is based on percent retained value regardless of the original HP-OIT value.

TABLE 2. HDPE SEAM PROPERTIES

PROPERTY	TEST VALUE	TEST METHOD
Seam Shear Strength (min) (1)	80 lb/in	ASTM D 6392
Seam Peel Strength	52 lb/in	ASTM D 6392

TABLE 2. HDPE SEAM PROPERTIES

PROPERTY	TEST VALUE	TEST METHOD
(min) (1) (2)		

Note (1): Seam tests for peel and shear must fail in the Film Tear Bond mode. This is a failure in the ductile mode of one of the bonded sheets by tearing or breaking prior to complete separation of the bonded area.

Note (2): Where applicable, both tracks of a double hot wedge seam shall be tested for peel adhesion.

## 2.2 TESTS, INSPECTIONS, AND VERIFICATIONS

### 2.2.1 Manufacturing, Sampling, and Testing

#### 2.2.1.1 Raw Materials

Raw materials shall be tested in accordance with the approved MQC manual. Any raw material which fails to meet the geomembrane manufacturer's specified physical properties shall not be used in manufacturing the sheet.

Seaming rods and pellets shall be manufactured of materials which are essentially identical to that used in the geomembrane sheet. Seaming rods and pellets shall be tested for density, melt index and carbon black content in accordance with the approved MQC manual. Seaming rods and pellets which fail to meet the corresponding property values required for the sheet material, shall not be used for seaming.

#### 2.2.1.2 Sheet Material

Geomembrane sheets shall be tested in accordance with the approved MQC manual. As a minimum, MQC testing shall be conducted at the frequencies shown in Table 1. Sheets not meeting the minimum requirements specified in Table 1 shall not be sent to the site.

## PART 3 EXECUTION

### 3.1 PREPARATION

#### 3.1.1 Surface Preparation

Surface preparation shall be performed in accordance with Section 02300A. Rocks larger than 1/2 inch in diameter and any other material which could damage the geomembrane shall be removed from the surface to be covered with the geomembrane. Construction equipment tire or track deformations beneath the geomembrane shall not be greater than 1.0 inch in depth. Each day during placement of geomembrane, the QC Inspector and installer shall inspect the surface on which geomembrane is to be placed and certify in writing that the surface is acceptable. Repairs to the subgrade shall be performed at no additional cost to the Government.

#### 3.1.2 Anchor Trenches

Where an anchor trench is required, it shall be placed 24 inches back from the edge of the slope to be covered. The anchor trench shall be 24 inches deep and 18 inches wide. If the anchor trench is excavated in cohesive

soil susceptible to desiccation, only the amount of anchor trench required for placement of geomembrane in a single day shall be excavated. Ponded water shall be removed from the anchor trench while the trench is open. Trench corners shall be slightly rounded to avoid sharp bends in the geomembrane. Loose soil, rocks larger than 1/2 inch in diameter, and any other material which could damage the geomembrane shall be removed from the surfaces of the trench. The geomembrane shall extend down the front wall and across the bottom of the anchor trench. Backfilling and compaction of the anchor trench shall be in accordance with Section 02300A.

### 3.2 GEOMEMBRANE DEPLOYMENT

The procedures and equipment used shall not elongate, wrinkle, scratch, or otherwise damage the geomembrane, other geosynthetic layers, or the underlying subgrade. Geomembrane damaged during installation shall be replaced or repaired, at the QC inspector's discretion. Only geomembrane panels that can be anchored and seamed together the same day shall be deployed. Adequate ballast (i.e., sand bags) shall be placed on the geomembrane, without damaging the geomembrane, to prevent uplift by wind. No equipment shall be operated on the top surface of the geomembrane without permission from the Contracting Officer. Seams shall be oriented parallel to the line of maximum slope. Where seams can only be oriented across the slope, the upper panel shall be lapped over the lower panel.

#### 3.2.1 Wrinkles

The methods used to deploy and backfill over the geomembrane shall minimize wrinkles and tensile stresses in the geomembrane. The geomembrane shall have adequate slack to prevent the creation of tensile stress. The wrinkle height to width ratio for installed geomembrane shall not exceed 0.5. In addition, geomembrane wrinkles shall not exceed 6 inches in height. Wrinkles that do not meet the above criteria shall be cut out and repaired in accordance with the installer's approved QC manual.

### 3.3 FIELD SEAMING

#### 3.3.1 Trial Seams

Trial seams shall be made under field conditions on strips of excess geomembrane. Trial seams shall be made each day prior to production seaming, whenever there is a change in seaming personnel or seaming equipment and at least once every four hours, by each seamer and each piece of seaming equipment used that day. Trial seam samples shall be collected and tested in accordance with ASTM D 6392. One sample shall be obtained from each trial seam. This sample shall be at least 36 inches long by 12 inches wide with the seam centered lengthwise. Ten random specimens 1 inch wide shall be cut from the sample. Five seam specimens shall be field tested for shear strength and 5 seam specimens shall be field tested for peel adhesion using an approved quantitative tensiometer. To be acceptable, 4 out of 5 replicate test specimens shall meet seam strength requirements specified in Table 2. If the field tests fail to meet these requirements, the entire operation shall be repeated. If the additional trial seam fails, the seaming apparatus or seamer shall not be used until the deficiencies are corrected by the installer and 2 consecutive successful trial seams are achieved.

#### 3.3.2 Field Seams

Panels shall be seamed in accordance with the geomembrane manufacturer's

recommendations. In sumps, corners and odd-shaped geometric locations, the number of field seams shall be minimized. Seaming shall extend to the outside edge of panels. Soft subgrades shall be compacted and approved prior to seaming. The seam area shall be free of moisture, dust, dirt, and foreign material at the time of seaming. Fish mouths in seams shall be repaired.

#### 3.3.2.1 Polyethylene Seams

Polyethylene geomembranes shall be seamed by thermal fusion methods. Extrusion welding shall only be used for patching and seaming in locations where thermal fusion methods are not feasible. Seam overlaps that are to be attached using extrusion welds shall be ground prior to welding. Grinding marks shall be oriented perpendicular to the seam direction and no marks shall extend beyond the extrudate after placement. Extrusion welding shall begin within 10 minutes after grinding. Where extrusion welds are temporarily terminated long enough to cool, they shall be ground prior to applying new extrudate over the existing seam. The total depth of the grinding marks shall be no greater than 10 percent of the sheet thickness.

#### 3.4 SAMPLES

One QC sample, 18 inches in length, for the entire width of a roll, shall be obtained for every 100,000 square feet of material delivered to the site. Samples shall not be obtained from the first three feet of the roll.

The samples shall be identified by manufacturer's name, product identification, lot and roll/panel number. The date, a unique sample number, and the machine direction shall also be noted. In addition, a 12 inch by 12 inch QA sample shall be collected, labeled, and submitted to the Contracting Officer each time QC samples are collected.

#### 3.5 TESTS

The Contractor shall provide all QC samples to the QC laboratory to determine density, thickness, tensile strength at break, and elongation at break in accordance with the methods specified in Table 1. Samples not meeting the specified requirements shall result in the rejection of applicable rolls/panels. As a minimum, rolls/panels produced immediately prior to and immediately after the failed roll/panel shall be tested for the same failed parameter. Testing shall continue until a minimum of three successive rolls/panels on both sides of the original failing roll/panel pass the failed parameter.

##### 3.5.1 Non-Destructive Field Seam Continuity Testing

Field seams shall be non-destructively tested for continuity over their full length in accordance with the installer's approved QC manual. Seam testing shall be performed as the seaming work progresses, not at the completion of field seaming. Any seams which fail shall be documented and repaired in accordance with the installer's approved QC manual.

##### 3.5.2 Destructive Field Seam Testing

A minimum of one destructive test sample per 750 feet of field seam shall be obtained at locations specified by the QC inspector. Sample locations shall not be identified prior to seaming. Samples shall be a minimum of 12 inches wide by 42 inches long with the seam centered lengthwise. Each sample shall be cut into 3 equal pieces, with one piece retained by the installer, one piece given to the QC laboratory, and the remaining piece

given to the Contracting Officer for QA testing and/or permanent record. Each sample shall be numbered and cross referenced to a field log which identifies: (1) panel number; (2) seam number; (3) date and time cut; (4) ambient temperature within 6 inches above the geomembrane; (5) seaming unit designation; (6) name of seamer; and (7) seaming apparatus temperature and pressures (where applicable). Ten 1 inch wide replicate specimens shall be cut from the installer's sample. Five specimens shall be tested for shear strength and 5 for peel adhesion using an approved field quantitative tensiometer. Jaw separation speed shall be in accordance with the approved QC manual. To be acceptable, 4 out of 5 replicate test specimens shall meet the seam strength requirements specified in Table 2. If the field tests pass, 5 specimens shall be tested at the QC laboratory for shear strength and 5 for peel adhesion in accordance with the QC laboratory's approved procedures. To be acceptable, 4 out of 5 replicate test specimens shall meet the seam strength requirements specified in Table 2. If the field or laboratory tests fail, the seam shall be repaired in accordance with paragraph Destructive Seam Test Repairs. Holes for destructive seam samples shall be repaired the same day they are cut.

### 3.6 DEFECTS AND REPAIRS

#### 3.6.1 Destructive Seam Test Repairs

Seams that fail destructive seam testing may be overlaid with a strip of new material and seamed (cap stripped). Alternatively, the seaming path shall be retraced to an intermediate location a minimum of 10 feet on each side of the failed seam location. At each location a 12 by 18 inch minimum size seam sample shall be taken for 2 additional shear strength and 2 additional peel adhesion tests using an approved quantitative field tensiometer. If these tests pass, then the remaining seam sample portion shall be sent to the QC laboratory for 5 shear strength and 5 peel adhesion tests in accordance with the QC laboratory's approved procedures. To be acceptable, 4 out of 5 replicate test specimens must meet specified seam strength requirements. If these laboratory tests pass, then the seam shall be cap stripped or repaired using other approved methods between that location and the original failed location. If field or laboratory tests fail, the process shall be repeated. After repairs are completed, the repaired seam shall be non-destructively tested in accordance with paragraph Non-Destructive Field Seam Continuity Testing.

#### 3.6.2 Patches

Tears, holes, blisters and other defects shall be repaired with patches. Patches shall have rounded corners, be made of the same geomembrane, and extend a minimum of 6 inches beyond the edge of defects. Minor localized flaws shall be repaired by spot welding or seaming as determined by the QC inspector. Repairs shall be non-destructively tested. The Contracting Officer or the QC inspector may also elect to perform destructive seam tests on suspect areas.

### 3.7 VISUAL INSPECTION AND EVALUATION

Immediately prior to covering, the geomembrane, seams, and non-seam areas shall be visually inspected by the QC inspector and Contracting Officer for defects, holes, or damage due to weather conditions or construction activities. At the Contracting Officer's or the QC inspector's discretion, the surface of the geomembrane shall be brushed, blown, or washed by the installer if the amount of dust, mud, or foreign material inhibits inspection. Each suspect location shall be non-destructively tested in

accordance with paragraph Non-Destructive Field Seam Continuity Testing. Each location that fails non-destructive testing shall be repaired in accordance with paragraph Patches and non-destructively retested.

### 3.8 PENETRATIONS

Geomembrane penetration details shall be in accordance with ASTM D 6497 or as recommended by the geomembrane manufacturer. Factory fabricated boots shall be used wherever possible. Field seams for penetrations shall be non-destructively tested in accordance with the installer's approved QC manual. Seams that fail non-destructive testing shall be repaired in accordance with the installer's approved QC manual and non-destructively tested prior to acceptance.

### 3.9 PROTECTION AND BACKFILLING

The deployed and seamed geomembrane shall be covered with the specified material within 14 calendar days of acceptance. Wrinkles in the geomembrane shall be prevented from folding over during placement of cover materials. Cover soil shall not be dropped onto the geomembrane or overlying geosynthetics from a height greater than 3 feet. The soil shall be pushed out over the geomembrane or overlying geosynthetics in an upward tumbling motion. The initial loose soil lift thickness shall be 12 inches.

Equipment with ground pressures less than 7 psi shall be used to place the first lift over the geomembrane. A minimum of 18 inches of soil shall be maintained between construction equipment with ground pressures greater than 7 psi and the geomembrane. Cover soil compaction and testing requirements are described in Section 02300A. Equipment placing cover soil shall not stop abruptly, make sharp turns, spin their wheels, or travel at speeds exceeding 5 mph.

### 3.10 AS-BUILT DRAWINGS

Final as-built drawings of the geomembrane installation shall be prepared. These drawings shall include panel numbers, seam numbers, location of repairs, destructive seam samples, and penetrations.

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## SECTION 02371

PROTECTION GEOTEXTILE FOR PONDS  
09/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 4354	(1999) Sampling of Geosynthetics for Testing
ASTM D 4355	(1999) Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)
ASTM D 4533	(1991; R 1996) Trapezoid Tearing Strength of Geotextiles
ASTM D 4632	(1991; R 1997) Grab Breaking Load and Elongation of Geotextiles
ASTM D 4759	(1988; R 1996) Determining the Specification Conformance of Geosynthetics
ASTM D 4833	(2000) Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM D 4873	(2001) Identification, Storage, and Handling of Geosynthetic Rolls and Samples

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-03 Product Data

Manufacturing Quality Control Manual Sampling and Testing; G-AO

A minimum of 7 days prior to scheduled use, manufacturer's quality control manual.

## SD-04 Samples

## Quality Assurance Samples and Tests; G-AO

Samples for quality assurance testing; 7 days shall be allotted in the schedule to allow for testing.

## SD-07 Certificates

## Geotextile; G-AO

A minimum of 7 days prior to scheduled use, manufacturer's certificate of compliance stating that the geotextile meets the requirements of this section. For needle punched geotextiles, the manufacturer shall also certify that the geotextile has been continuously inspected using permanent on-line full-width metal detectors and does not contain any needles which could damage other geosynthetic layers. The certificate of compliance shall be attested to by a person having legal authority to bind the geotextile manufacturer.

## 1.3 DELIVERY, STORAGE AND HANDLING

Delivery, storage, and handling of geotextile shall be in accordance with ASTM D 4873.

## 1.3.1 Delivery

The Contracting Officer shall be notified a minimum of 24 hours prior to delivery and unloading of geotextile rolls. Rolls shall be packaged in an opaque, waterproof, protective plastic wrapping. The plastic wrapping shall not be removed until deployment. If quality assurance samples are collected, rolls shall be immediately rewrapped with the plastic wrapping. Geotextile or plastic wrapping damaged during storage or handling shall be repaired or replaced, as directed. Each roll shall be labeled with the manufacturer's name, geotextile type, roll number, roll dimensions (length, width, gross weight), and date manufactured.

## 1.3.2 Storage

Rolls of geotextile shall be protected from construction equipment, chemicals, sparks and flames, temperatures in excess of 160 degrees F, or any other environmental condition that may damage the physical properties of the geotextile. To protect geotextile from becoming saturated, rolls shall either be elevated off the ground or placed on a sacrificial sheet of plastic in an area where water will not accumulate.

## 1.3.3 Handling

Geotextile rolls shall be handled and unloaded with load carrying straps, a fork lift with a stinger bar, or an axial bar assembly. Rolls shall not be dragged along the ground, lifted by one end, or dropped to the ground.

## PART 2 PRODUCTS

## 2.1 RAW MATERIALS

## 2.1.1 Geotextile

Geotextile shall be a nonwoven pervious sheet of polymeric material and shall consist of long-chain synthetic polymers composed of at least 95

percent by weight polyolefins, polyesters, or polyamides. Stabilizers and/or inhibitors shall be added to the base polymer, as needed, to make the filaments resistant to deterioration by ultraviolet light, oxidation, and heat exposure. Regrind material, which consists of edge trimmings and other scraps that have never reached the consumer, may be used to produce the geotextile. Post-consumer recycled material may also be used. Geotextile shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including the edges. Geotextiles shall meet the requirements specified in Table 1. Where applicable, Table 1 property values represent minimum average roll values (MARV) in the weakest principal direction. Values for AOS represent maximum average roll values.

TABLE 1  
MINIMUM PHYSICAL REQUIREMENTS FOR PROTECTION GEOTEXTILE

PROPERTY	UNITS	ACCEPTABLE VALUES	TEST METHOD
GRAB STRENGTH	LBS	300	ASTM D 4632
PUNCTURE	LBS	140	ASTM D 4833
TRAPEZOID TEAR	LBS	115	ASTM D 4533
ULTRAVIOLET DEGRADATION	PERCENT	70 AT 500 HRS	ASTM D 4355

## 2.2 MANUFACTURING QUALITY CONTROL SAMPLING AND TESTING

The Manufacturer shall be responsible for establishing and maintaining a quality control program to assure compliance with the requirements of the specification. Documentation describing the quality control program shall be made available upon request. Manufacturing quality control sampling and testing shall be performed in accordance with the manufacturer's approved quality control manual. As a minimum, geotextiles shall be randomly sampled for testing in accordance with ASTM D 4354, Procedure A. Acceptance of geotextile shall be in accordance with ASTM D 4759. Tests not meeting the specified requirements shall result in the rejection of applicable rolls.

## PART 3 EXECUTION

### 3.1 QUALITY ASSURANCE SAMPLES AND TESTS

#### 3.1.1 Quality Assurance Samples

The Contractor shall provide assistance to the Contracting Officer in the collection of quality assurance samples. Samples shall be collected upon delivery to the site for quality assurance testing at the request of the Contracting Officer. Samples shall be identified with a waterproof marker by manufacturer's name, product identification, lot number, roll number, and machine direction. The date and a unique sample number shall also be noted on the sample. The outer layer of the geotextile roll shall be discarded prior to sampling a roll. Samples shall then be collected by cutting the full-width of the geotextile sheet a minimum of 3 feet long in the machine direction. Rolls which are sampled shall be immediately resealed in their protective covering.

### 3.1.2 Quality Assurance Tests

The Contractor shall provide quality assurance samples to an Independent Laboratory. Samples will be tested to verify that geotextile meets the requirements specified in Table 1. Test method ASTM D 4355 shall not be performed on the collected samples. Geotextile product acceptance shall be based on ASTM D 4759. Tests not meeting the specified requirements shall result in the rejection of applicable rolls.

## 3.2 INSTALLATION

### 3.2.1 Subgrade Preparation

The surface underlying the geotextile shall be smooth and free of ruts or protrusions which could damage the geotextile. Subgrade materials and compaction requirements shall be in accordance with Section 02300A.

### 3.2.2 Placement

The Contractor shall notify the Contracting Officer a minimum of 24 hours prior to installation of geotextile. Geotextile rolls which are damaged or contain imperfections shall be repaired or replaced as directed. The geotextile shall be laid flat and smooth so that it is in direct contact with the subgrade. The geotextile shall also be free of tensile stresses, folds, and wrinkles. On slopes steeper than 10 horizontal on 1 vertical, the geotextile shall be laid with the machine direction of the fabric parallel to the slope direction.

## 3.3 SEAMS

### 3.3.1 Overlap Seams

Geotextile panels shall be continuously overlapped a minimum of 12 inches at all longitudinal and transverse joints. Where seams must be oriented across the slope, the upper panel shall be lapped over the lower panel. If approved, sewn seams may be used instead of overlapped seams.

## 3.4 PROTECTION

The geotextile shall be protected during installation from clogging, tears, and other damage. Damaged geotextile shall be repaired or replaced as directed. Adequate ballast (e.g. sand bags) shall be used to prevent uplift by wind. The geotextile shall not be left uncovered for more than 14 days after installation.

## 3.5 REPAIRS

Torn or damaged geotextile shall be repaired. Repairs shall be performed by placing a patch of the same type of geotextile over the damaged area. The patch shall extend a minimum of 12 inches beyond the edge of the damaged area. Patches shall be continuously fastened using approved methods. The machine direction of the patch shall be aligned with the machine direction of the geotextile being repaired. Geotextile rolls which cannot be repaired shall be removed and replaced. Repairs shall be performed at no additional cost to the Government

## 3.6 PENETRATIONS

Engineered penetrations of the geotextile shall be constructed by methods

recommended by the geotextile manufacturer.

### 3.7 COVERING

Geotextile shall be used to protect the geomembrane from puncture from the anchor trench to the top of the pond as shown on the plans. Geotextile shall not be covered prior to inspection and approval by the Contracting Officer. Cover soil shall be placed in a manner that prevents soil from entering the geotextile overlap zone, prevents tensile stress from being mobilized in the geotextile, and prevents wrinkles from folding over onto themselves. Cover soil shall not be dropped onto the geotextile from a height greater than 3 feet. No equipment shall be operated directly on top of the geotextile without approval of the Contracting Officer. Equipment with ground pressures less than 7 psi shall be used to place the first lift over the geotextile. Where possible, a minimum of 12 inches of soil shall be maintained between full-scale construction equipment and the geotextile.

Cover soil material type, compaction, and testing requirements are described in Sections 02300A and 02560. Equipment placing cover soil shall not stop abruptly, make sharp turns, spin their wheels, or travel at speeds exceeding 5 mph.

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SECTION 02372A

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## SECTION 02372A

GEOMEMBRANE BENEATH SLABS-ON-GRADE  
10/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of the specification to the extent referenced. The publications are referenced in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 638	(1999) Tensile Properties of Plastics
ASTM D 1004	(1994a) Initial Tear Resistance of Plastic Film and Sheeting
ASTM D 1505	(1998) Density of Plastics by the Density-Gradient Technique
ASTM D 1603	(1994) Carbon Black in Olefin Plastics
ASTM D 3895	(1998) Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
ASTM D 4218	(1996) Test Method for Determination of Carbon Black Content in Polyethylene Compounds By the Muffle-Furnace Technique
ASTM D 4833	(2000) Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM D 5199	(1999) Measuring Nominal Thickness of Geotextiles and Geomembranes
ASTM D 5397	(1995) Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
ASTM D 5596	(1994) Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
ASTM D 5721	(1995) Air-Oven Aging of Polyolefin Geomembranes
ASTM D 5885	(1997) Oxidative Induction Time of Polyolefin Geosynthetics by High-Pressure Differential Scanning Calorimetry

## GEOSYNTHETIC INSTITUTE (GSI)

GSI GRI GM-11

(1997) Accelerated Weathering of  
Geomembrane Using a Fluorescent UVA Device

## 1.2 DELIVERY, STORAGE AND HANDLING

## 1.2.1 Storage

Temporary storage at the project site shall be on a level surface, free of sharp objects where water cannot accumulate. The geomembrane shall be protected from puncture, abrasion, excessive heat or cold, material degradation, or other damaging circumstances. Storage shall not result in crushing the core of roll goods or flattening of the rolls. Rolls shall not be stored more than two high. Palleted materials shall be stored on level surfaces and shall not be stacked on top of one another. Ultraviolet sensitive materials (i.e., PVC) shall be covered with a sacrificial opaque and waterproof covering or placed in a temporary shelter. Damaged geomembrane shall be removed from the site and replaced with geomembrane that meets the specified requirements.

## PART 2 PRODUCTS

## 2.1 MATERIALS

## 2.1.1 Raw Materials

Resin used in manufacturing geomembrane sheets shall be made of virgin uncontaminated ingredients. No more than 10 percent regrind, reworked, or trim material in the form of chips or edge strips shall be used to manufacture the geomembrane sheets. All regrind, reworked, or trim materials shall be from the same manufacturer and exactly the same formulation as the geomembrane sheet being produced. No post consumer materials or water-soluble ingredients shall be used to produce the geomembrane. For geomembranes with plasticizers, only primary plasticizers that are resistant to migration shall be used.

## 2.1.2 Sheet Materials

Geomembrane sheets shall be unreinforced and manufactured as wide as possible to minimize factory and field seams. Geomembrane sheets shall be uniform in color, thickness, and surface texture. The sheets shall be free of and resistant to fungal or bacterial attack and free of cuts, abrasions, holes, blisters, contaminants and other imperfections. Geomembrane sheets and factory seams shall conform to the requirements listed in Table 1 for Manufacturing Quality Control (MQC).

TABLE 1. SMOOTH HDPE GEOMEMBRANE PROPERTIES

PROPERTY	TEST VALUE	MQC TESTING FREQUENCY (MIN.)	TEST METHOD
Thickness (min ave)	20 mils	per roll	ASTM D 5199

TABLE 1. SMOOTH HDPE GEOMEMBRANE PROPERTIES

PROPERTY	TEST VALUE	MQC TESTING FREQUENCY (MIN.)	TEST METHOD
Lowest individual of 10 values	-10 percent	per roll	ASTM D 5199
Density (min)	0.939 g/cc	per 200,000 lb	ASTM D 1505
Tensile Properties (1) (min ave)		per 20,000 lb	ASTM D 638 Type IV
-break stress	75 lb/in		
-break elong	800 percent		
Tear Resistance (min ave)	11 lb	per 45,000 lb	ASTM D 1004
Puncture Resistance (min ave)	27 lb	per 45,000 lb	ASTM D 4833
Stress Crack Resistance (2)	200 hr	per 200,000 lb	ASTM D 5397 (Appendix)
Carbon Black Content	2.0-3.0 percent	per 45,000 lb	ASTM D 1603 (3)
Carbon Black Dispersion	Note (4)	per 45,000 lb	ASTM D 5596
Oxidative Induction Time (OIT) (min ave) (5)		per 200,000 lb	
-Std OIT or -High Pres OIT	100 min 400 min		ASTM D 3895 ASTM D 5885
Oven Aging at 85 deg C (min ave) (5), (6)		per year and change in formulation	ASTM D 5721
-Std OIT or -High Pres OIT	35 percent at 90 days 60 percent at 90 days		ASTM D 3895 ASTM D 5885
UV Resistance (min ave) (7)		per year and change in	GSI GRI GM-11

TABLE 1. SMOOTH HDPE GEOMEMBRANE PROPERTIES

PROPERTY	TEST VALUE	MQC TESTING FREQUENCY (MIN.)	TEST METHOD
		formulation	
-High Pres OIT	35 percent at 1600 hours		ASTM D 5885

TABLE 1 NOTES:

Note (1): Minimum average machine direction and minimum average cross machine direction values shall be based on 5 test specimens in each direction. Yield elongation is calculated using a gauge length of 1.3 inches. Break elongation is calculated using a gauge length of 2.0 inches.

Note (2): The yield stress used to calculate the applied load for test method ASTM D 5397 (Appendix), shall be the manufacturer's mean value.

Note (3): Other methods such as ASTM D 4218 or microwave methods are acceptable if an appropriate correlation to ASTM D 1603 can be established.

Note (4): Carbon black dispersion for 10 different views:  
 - minimum 8 of 10 in Categories 1 or 2  
 - all 10 in Categories 1,2, or 3

Note (5): The manufacturer has the option to select either one of the OIT methods to evaluate the antioxidant content.

Note (6): Evaluate samples at 30 and 60 days and compare with the 90 day response.

Note (7): The condition of the test shall be a 20 hour UV cycle at 167 degrees F followed by a 4 hour condensation cycle at 140 degrees F.

## PART 3 EXECUTION

## 3.1 PREPARATION

## 3.1.1 Surface Preparation

Surface preparation shall be performed in accordance with Section 02315a EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS. Rocks larger than 1/2 inch in diameter and any other material which could damage the geomembrane shall be removed from the surface to be covered with the geomembrane.

## 3.2 GEOMEMBRANE PLACEMENT

The procedures and equipment used shall not elongate, wrinkle, scratch, or otherwise damage the geomembrane, other geosynthetic layers, or the underlying subgrade. Geomembrane damaged during installation shall be replaced or repaired, at the Contracting Officer's discretion, at no

additional cost to the Government.

### 3.2.1 Wrinkles

The methods used to deploy and backfill over the geomembrane shall minimize wrinkles and tensile stresses in the geomembrane. The geomembrane shall have adequate slack to prevent the creation of tensile stress. The wrinkle height to width ratio for installed geomembrane shall not exceed 0.5. In addition, geomembrane wrinkles shall not exceed 6 inches in height. Wrinkles that do not meet the above criteria shall be cut out and repaired in accordance with the installer's approved QC manual.

### 3.3 SEAMS

Geomembrane panels shall be continuously overlapped a minimum of 6 inches.

### 3.4 DEFECTS AND REPAIRS

#### 3.4.1 Patches

Tears, holes, blisters and other defects shall be repaired with patches. Patches shall have rounded corners, be made of the same geomembrane, and extend a minimum of 6 inches beyond the edge of defects.

### 3.5 VISUAL INSPECTION AND EVALUATION

Immediately prior to covering, the geomembrane shall be visually inspected by the installer and Contracting Officer for defects, holes, or damage due to weather conditions or construction activities. At the Contracting Officer's discretion, the surface of the geomembrane shall be brushed, blown, or washed by the installer if the amount of dust, mud, or foreign material inhibits inspection or functioning of the overlying material.

### 3.6 PROTECTION AND BACKFILLING

The geomembrane shall be overlain with a geotextile as specified in Section 02373a prior to placement of the capillary water barrier material. The geomembrane shall be covered with geotextile and capillary water barrier within 14 calendar days of acceptance. Wrinkles in the geomembrane shall be prevented from folding over during placement of cover materials.

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-- End of Section Table of Contents --

## SECTION 02373

GEOTEXTILE BENEATH SLABS-ON-GRADE  
09/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 4355	(1999) Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)
ASTM D 4491	(1999a) Water Permeability of Geotextiles by Permittivity
ASTM D 4533	(1991; R 1996) Trapezoid Tearing Strength of Geotextiles
ASTM D 4632	(1991; R 1997) Grab Breaking Load and Elongation of Geotextiles
ASTM D 4751	(1999a) Determining Apparent Opening Size of a Geotextile
ASTM D 4833	(2000) Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM D 4873	(2001) Identification, Storage, and Handling of Geosynthetic Rolls and Samples

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-03 Product Data

Manufacturing Quality Control Manual Sampling and Testing; G-AO

A minimum of 14 days prior to scheduled use, manufacturer's quality control manual including instructions for storage, handling, installation, seaming and repair.

## SD-07 Certificates

### Geotextile; G-A0

A minimum of 14 days prior to scheduled use, manufacturer's certificate of compliance stating that the geotextile meets the requirements of this section, and copies of manufacturer's quality control test results.

## 1.3 DELIVERY, STORAGE AND HANDLING

Delivery, storage, and handling of geotextile shall be in accordance with ASTM D 4873.

### 1.3.1 Delivery

Rolls shall be packaged in an opaque, waterproof, protective plastic wrapping. The plastic wrapping shall not be removed until deployment. If quality assurance samples are collected, rolls shall be immediately rewrapped with the plastic wrapping. Geotextile or plastic wrapping damaged during storage or handling shall be repaired or replaced, as directed. Each roll shall be labeled with the manufacturer's name, geotextile type, roll number, roll dimensions (length, width, gross weight), and date manufactured.

### 1.3.2 Storage

Rolls of geotextile shall be protected from construction equipment, chemicals, sparks and flames, temperatures in excess of 160 degrees F, or any other environmental condition that may damage the physical properties of the geotextile. To protect geotextile from becoming saturated, rolls shall either be elevated off the ground or placed on a sacrificial sheet of plastic in an area where water will not accumulate.

### 1.3.3 Handling

Geotextile rolls shall be handled and unloaded with load carrying straps, a fork lift with a stinger bar, or an axial bar assembly. Rolls shall not be dragged along the ground, lifted by one end, or dropped to the ground.

## PART 2 PRODUCTS

### 2.1 RAW MATERIALS

#### 2.1.1 Geotextile

Geotextile shall be a nonwoven pervious sheet of polymeric material and shall consist of long-chain synthetic polymers composed of at least 95 percent by weight polyolefins, polyesters, or polyamides. Stabilizers and/or inhibitors shall be added to the base polymer, as needed, to make the filaments resistant to deterioration by ultraviolet light, oxidation, and heat exposure. Regrind material, which consists of edge trimmings and other scraps that have never reached the consumer, may be used to produce the geotextile. Post-consumer recycled material may also be used. Geotextile shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including the edges. Geotextiles shall meet the requirements specified in Table 1. Where applicable, Table 1 property values represent minimum average roll values (MARV) in the weakest principal direction. Values for AOS represent maximum average roll values.

TABLE 1  
MINIMUM PHYSICAL REQUIREMENTS FOR DRAINAGE GEOTEXTILE

PROPERTY	ACCEPTABLE VALUES	TEST METHOD
GRAB STRENGTH	200 pounds	ASTM D 4632
ELONGATION AT BREAK	> 50%	ASTM D 4632
PUNCTURE	80 pounds	ASTM D 4833
TRAPEZOID TEAR	80 pounds	ASTM D 4533
APPARENT OPENING SIZE	0.00835 inches	ASTM D 4751
PERMITTIVITY	0.5 sec <sup>-1</sup>	ASTM D 4491
ULTRAVIOLET DEGRADATION (strength retained at 500 hours)	50%	ASTM D 4355

### PART 3 EXECUTION

#### 3.1 QUALITY ASSURANCE SAMPLES AND TESTS

#### 3.2 INSTALLATION

##### 3.2.1 Placement

Geotextile rolls which are damaged or contain imperfections shall be repaired or replaced as directed. The geotextile shall be laid flat and smooth so that it is in direct contact with the geomembrane and subgrade. The geotextile shall also be free of tensile stresses, folds, and wrinkles.

#### 3.3 SEAMS

##### 3.3.1 Overlap Seams

Geotextile panels shall be continuously overlapped a minimum of 12 inches at all longitudinal and transverse joints.

#### 3.4 PROTECTION

The geotextile shall be protected during installation from clogging, tears, and other damage. Damaged geotextile shall be repaired or replaced as directed. The geotextile shall not be left uncovered for more than 14 days after installation.

#### 3.5 REPAIRS

Torn or damaged geotextile shall be repaired. Clogged areas of geotextile shall be removed. Repairs shall be performed by placing a patch of the

same type of geotextile over the damaged area. The patch shall extend a minimum of 12 inches beyond the edge of the damaged area. Patches shall be continuously fastened using approved methods. The machine direction of the patch shall be aligned with the machine direction of the geotextile being repaired. Geotextile rolls which cannot be repaired shall be removed and replaced. Repairs shall be performed at no additional cost to the Government

### 3.6 PENETRATIONS

Engineered penetrations of the geotextile shall be constructed by methods recommended by the geotextile manufacturer.

### 3.7 COVERING

Geotextile shall not be covered with capillary water barrier prior to inspection and approval by the Contracting Officer. Capillary water barrier shall be placed in a manner that prevents material from entering the geotextile overlap zone, prevents tensile stress from being mobilized in the geotextile, and prevents wrinkles from folding over onto themselves. No equipment shall be operated directly on top of the geotextile.

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## SECTION 02440

## TRAFFIC SIGNS

10/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 653	(2001) Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
ASTM A 1011	(2000) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B 209	(2001) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM D 4956	(2001) Retroreflective Sheeting for Traffic Control

## FEDERAL HIGHWAY ADMINISTRATION

MUTCD	(2000) Manual on Uniform Traffic Control Devices
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## 1.2 SUBMITTALS (NOT USED)

## 1.3 GENERAL

All sign faces shall conform to MUTCD.

## PART 2 PRODUCTS

## 2.1 SIGN POSTS

## 2.1.1 Perforated Steel Tubing

Steel posts shall be fabricated from perforated square steel tubing conforming to ASTM A 1011, Grade 50. Steel tubing shall be galvanized in accordance with ASTM A 653. Holes shall be approximately 7/16 inch in diameter spaced at approximately 1 nch on centers.

## 2.2 ALUMINUM SIGN PANELS

Aluminum sign panels shall conform to ASTM B 209, alloy no.-temper 6061-T6 or 5052-H38. The blanks shall be free from laminations, blisters, open

seams, pits, holes, other defects that may affect their appearance or use. The thickness shall be uniform and the blank commercially flat.

### 2.3 RETROREFLECTIVE SHEETING

Retroreflective sheeting shall conform to ASTM D 4956, Type I, II, III, IV, V, or VI. Type I retroreflective sheeting shall conform to ASTM D 4956, except the minimum coefficients of retroreflection for brown type I sheeting shown in Table I of ASTM D 4956 are amended as follows: 2.0 cd/fc/ft<sup>2</sup> at 0.2 degrees observation angle and -4 degrees entrance angle, 1.0 cd/fc/ft<sup>2</sup> at 0.2 degrees observation angle and +30 degrees entrance angle and at 0.5 degrees observation angle and -4 degrees entrance angle, and 0.5 cd/fc/ft<sup>2</sup> at 0.5 degrees observation angle and +30 degrees entrance angle. All retroreflective sheeting shall have a precoated adhesive which will permanently adhere to the sign panel surface.

### 2.4 HARDWARE

Bolts, nuts and metal washers shall be either aluminum alloy or commercial quality steel, hot-dip galvanized or cadmium plated after fabrication. Fiber washers shall be of commercial quality.

## PART 3 EXECUTION

### 3.1 GENERAL

### 3.2 SIGN POSTS

Steel sign posts shall be set in concrete foundations.

### 3.3 SIGN PANELS

Clean, degrease and etch the face of metal panels using methods recommended by the retroreflective sheeting manufacturer. After cleaning and degreasing, retroreflective sheeting material shall be applied to the sign panels as recommended by the manufacturer. Shearing, cutting and punching shall be performed prior to preparing the blanks for application of reflective material. Holes shall not be field drilled in any part of the panel. Any damaged sign panels shall be replaced at no additional cost to the Government.

### 3.4 LETTERS, NUMERALS, ARROWS, SYMBOLS, AND BORDERS

Letters, numerals, arrows, symbols, and borders shall be applied on the retroreflective sheeting or opaque background of the sign using the direct or reverse screen process. Messages and borders of a color darker than the background shall be applied to the paint or the retroreflective sheeting using the direct process. Messages and borders shall be of a color lighter than the sign background and shall be applied using the reverse screen process. Opaque or transparent colors, inks, and paints of the type and quality recommended by the retroreflective sheeting manufacturer shall be used in the screen process. The screening shall be performed in a manner that results in a uniform color and tone, with sharply defined edges of legends and borders and without blemishes on the sign background that will affect intended use. The signs shall be air dried or baked after screening according to the manufacturer's recommendations to provide a smooth hard finish. Any signs with blisters or other blemishes shall be rejected.

### 3.5 LOCATION AND POSITION OF SIGNS

All signs shall be located and erected in accordance with the drawings and MUTCD. Unless otherwise shown, signs shall be erected with the sign faces and posts vertical. To reduce specular glare (mirror reflection), sign panels shall be turned 3 degrees away from the road in the direction of travel. The Contracting Officer's Representative shall inspect all signs for specular reflection at night after installation has been completed. If specular reflection is apparent on any sign, it shall be adjusted by the Contractor at his expense to eliminate or minimize specular reflection to the satisfaction of the Contracting Officer's Representative.

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## SECTION 02510A

## WATER DISTRIBUTION SYSTEM

04/98

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1784	(1999a) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 1785	(1999) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2241	(2000) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2464	(1999) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(2001) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(2001) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2564	(1996a) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2657	(1997) Heat Fusion Joining Polyolefin Pipe and Fittings
ASTM D 2774	(2001) Underground Installation of Thermoplastic Pressure Piping
ASTM D 2855	(1996) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM F 477	(1999) Elastomeric Seals (Gaskets) for Joining Plastic Pipe

## ASME INTERNATIONAL (ASME)

ASME B1.20.1	(1983; R 1992) Pipe Threads, General
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## Purpose (Inch)

## AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA B300	(1999) Hypochlorites
AWWA B301	(1999) Liquid Chlorine
AWWA C104	(1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110	(1998) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other Liquids
AWWA C111	(2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C153	(2000) Ductile-Iron Compact Fittings, 3 In. Through 24 In. (76 mm through 610 mm) and 54 In. through 64 In. (1,400 mm through 1,600 mm) for Water Service
AWWA C500	(1993; C500a) Metal-Sealed Gate Valves for Water Supply Service
AWWA C502	(1994; C502a) Dry-Barrel Fire Hydrants
AWWA C504	(1994) Rubber-Seated Butterfly Valves
AWWA C509	(2001) Resilient-Seated Gate Valves for Water Supply Service
AWWA C800	(2001) Underground Service Line Valves and Fittings
AWWA C900	(1997; C900a) Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution
AWWA C901	(1996) Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. Through 3 In., for Water Service
AWWA M23	(1980) Manual: PVC Pipe - Design and Installation

## ASBESTOS CEMENT PIPE PRODUCERS ASSOCIATION (ACPPA)

ACPPA Work Practices	(1988) Recommended Work Practices for A/C Pipe
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## DUCTILE IRON PIPE RESEARCH ASSOCIATION (DIPRA)

DIPRA-Restraint Design	(1997) Thrust Restraint Design for Ductile Iron Pipe
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## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 24	(1995) Installation of Private Fire Service Mains and Their Appurtenances
NFPA 704	(2001) Identification of the Hazards of Materials for Emergency Response
NSF INTERNATIONAL (NSF)	
NSF 14	(2002) Plastics Piping Components and Related Materials
NSF 61	(2001) Drinking Water System Components - Health Effects (Sections 1-9)
THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)	
SSPC Paint 21	(1991) White or Colored Silicone Alkyd Paint
SSPC Paint 25	(1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (Without Lead and Chromate Pigments)

## 1.2 PIPING

This section covers water distribution and service lines, and connections to building service at a point approximately 5 feet outside buildings and structures to which service is required. The Contractor shall have a copy of the manufacturer's recommendations for each material or procedure to be utilized available at the construction site at all times.

### 1.2.1 Service Lines

Piping for water service lines less than 3 inches in diameter shall be polyvinyl chloride (PVC) plastic, polyethylene, unless otherwise shown or specified. Piping for water service lines 3 inches and larger shall be polyvinyl chloride (PVC) plastic, unless otherwise shown or specified.

### 1.2.2 Distribution Lines 3 Inches or Larger

Piping for water distribution lines 3 inches or larger shall be polyvinyl chloride (PVC) through 36 inch nominal diameter plastic, unless otherwise shown or specified.

### 1.2.3 Sprinkler Supply Lines

Piping for water lines supplying sprinkler systems for building fire protection shall conform to NFPA 24 from the point of connection with the water distribution system to the building 5 foot line.

### 1.2.4 Potable Water Lines

Piping and components of potable water systems which come in contact with the potable water shall conform to NSF 61.

### 1.2.5 Plastic Piping System

Plastic piping system components (PVC, polyethylene) intended for

transportation of potable water shall comply with NSF 14 and be legibly marked with their symbol.

#### 1.2.6 Excavation, Trenching, and Backfilling

Excavation, trenching, and backfilling shall be in accordance with the applicable provisions of Section 02316a EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS, except as modified herein.

#### 1.3 MANUFACTURER'S REPRESENTATIVE

The Contractor shall have a manufacturer's field representative present at the jobsite during the installation and testing of PE pipe to provide technical assistance and to verify that the materials are being installed in accordance with the manufacturer's prescribed procedures. When the representative feels that the Contractor is installing and testing the PE pipe in a satisfactory manner, certification shall be written to note which individuals employed by the Contractor are capable of properly installing the pipe. The field representative shall advise the Contractor of unsatisfactory conditions immediately when they occur. Such conditions include improper diameter of pipe ends, damaged interior liner, poorly prepared joints, improper curing of joints, moving pipe before joints are cured, bending pipe to follow abrupt changes in trench contours, leaving pipe ends open in trench overnight, not properly drying joints after rain storms, exceeding effective adhesive life, sharp objects in trench bed, backfill that could damage pipe, improper procedure for concrete encasement of pipe, omission of thrust blocks at changes in direction or any other condition which could have an adverse effect on the satisfactory completion and operation of the piping system.

#### 1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

##### SD-03 Product Data

###### Installation;

The manufacturer's recommendations for each material or procedure to be utilized.

###### Waste Water Disposal Method;

The method proposed for disposal of waste water from hydrostatic tests and disinfection, prior to performing hydrostatic tests.

###### Satisfactory Installation;

A statement signed by the principal officer of the contracting firm stating that the installation is satisfactory and in accordance with the contract drawings and specifications, and the manufacturer's prescribed procedures and techniques, upon completion of the project and before final acceptance.

##### SD-06 Test Reports

**Bacteriological Disinfection;**

Test results from commercial laboratory verifying disinfection.

**SD-07 Certificates****Manufacturer's Representative;**

The name and qualifications of the manufacturer's representative and written certification from the manufacturer that the representative is technically qualified in all phases of PE pipe laying and jointing and experienced to supervise the work and train the Contractor's field installers, prior to commencing installation.

**Installation;**

A statement signed by the manufacturer's field representative certifying that the Contractor's personnel are capable of properly installing the pipe on the project.

**1.5 HANDLING**

Pipe and accessories shall be handled to ensure delivery to the trench in sound, undamaged condition, including no injury to the pipe coating or lining. If the coating or lining of any pipe or fitting is damaged, the repair shall be made by the Contractor in a satisfactory manner, at no additional cost to the Government. No other pipe or material shall be placed inside a pipe or fitting after the coating has been applied. Pipe shall be carried into position and not dragged. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the Government. Rubber gaskets that are not to be installed immediately shall be stored in a cool and dark place.

**1.5.1 Polyethylene (PE) Pipe Fittings and Accessories**

PE pipe, fittings, and accessories shall be handled in conformance with AWWA C901.

**1.5.2 Miscellaneous Plastic Pipe and Fittings**

Polyvinyl Chloride (PVC) pipe and fittings shall be handled and stored in accordance with the manufacturer's recommendations. Storage facilities shall be classified and marked in accordance with NFPA 704.

**PART 2 PRODUCTS****2.1 PIPE**

Pipe shall conform to the respective specifications and other requirements

specified below.

2.1.1 Plastic Pipe

2.1.1.1 PE Plastic Pipe

Pipe, tubing, and heat-fusion fittings shall conform to AWWA C901.

2.1.1.2 PVC Plastic Pipe

Pipe, couplings and fittings shall be manufactured of material conforming to ASTM D 1784, Class 12454B.

a. Pipe Less Than 4 inch Diameter:

(1) Screw-Joint: Pipe shall conform to dimensional requirements of ASTM D 1785 Schedule 80, with joints meeting requirements of 150 psi working pressure, 200 psi hydrostatic test pressure, unless otherwise shown or specified. Pipe couplings when used, shall be tested as required by ASTM D 2464.

(2) Elastomeric-Gasket Joint: Pipe shall conform to dimensional requirements of ASTM D 1785 Schedule 40, with joints meeting the requirements of 150 psi working pressure, 200 psi hydrostatic test pressure, unless otherwise shown or specified, or it may be pipe conforming to requirements of ASTM D 2241, elastomeric joint, with the following applications:

SDR	Maximum Working Pressure psi	Minimum Hydrostatic Pressure psi
17	150	200

(3) Solvent Cement Joint: Pipe shall conform to dimensional requirements of ASTM D 1785 or ASTM D 2241 with joints meeting the requirements of 150 psi working pressure and 200 psi hydrostatic test pressure.

b. Pipe 4 through 12 inch Diameter: Pipe, couplings and fittings shall conform to AWWA C900, Class 150, CIOD pipe dimensions, elastomeric-gasket joint, unless otherwise shown or specified.

2.2 FITTINGS AND SPECIALS

2.2.1 PVC Pipe System

a. For pipe less than 4 inch diameter, fittings for threaded pipe shall conform to requirements of ASTM D 2464, threaded to conform to the requirements of ASME B1.20.1 for use with Schedule 80 pipe and fittings; fittings for solvent cement jointing shall conform to ASTM D 2466 or ASTM D 2467; and fittings for elastomeric-gasket joint pipe shall be iron conforming to AWWA C110 or AWWA C111. Iron fittings and specials shall be cement-mortar lined (standard

thickness) in accordance with AWWA C104.

- b. For pipe 4 inch diameter and larger, fittings and specials shall be iron, bell end in accordance with AWWA C110, 150 psi pressure rating unless otherwise shown or specified, except that profile of bell may have special dimensions as required by the pipe manufacturer; or fittings and specials may be of the same material as the pipe with elastomeric gaskets, all in conformance with AWWA C900. Iron fittings and specials shall be cement-mortar lined (standard thickness) in accordance with AWWA C104. Fittings shall be bell and spigot or plain end pipe, or as applicable. Ductile iron compact fittings shall be in accordance with AWWA C153.

## 2.3 JOINTS

### 2.3.1 Plastic Pipe Jointing

#### 2.3.1.1 PE Pipe

Joints for pipe fittings and couplings shall be strong tight joints as specified for PE in Paragraph INSTALLATION. Joints connecting pipe of differing materials shall be made in accordance with the manufacturer's recommendation, and as approved by the Contracting Officer.

#### 2.3.1.2 PVC Pipe

Joints, fittings, and couplings shall be as specified for PVC pipe. Joints connecting pipe of differing materials shall be made in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer.

## 2.4 VALVES

### 2.4.1 Gate Valves

Gate valves shall be designed for a working pressure of not less than 150 psi. Valve connections shall be as required for the piping in which they are installed. Valves shall have a clear waterway equal to the full nominal diameter of the valve, and shall be opened by turning counterclockwise. The operating nut or wheel shall have an arrow, cast in the metal, indicating the direction of opening.

- a. Valves 3 inches and larger shall be iron body, bronze mounted, and shall conform to AWWA C500. Flanges shall not be buried. An approved pit shall be provided for all flanged connections.
- b. Resilient-Seated Gate Valves: For valves 3 to 12 inches in size, resilient-seated gate valves shall conform to AWWA C509.

### 2.4.2 Rubber-Seated Butterfly Valves

Rubber-seated butterfly valves shall conform to the performance requirements of AWWA C504. Wafer type valves conforming to the performance requirements of AWWA C504 in all respects, but not meeting laying length requirements will be acceptable if supplied and installed with a spacer providing the specified laying length. All tests required by AWWA C504 shall be met. Flanged-end valves shall be installed in an approved pit and provided with a union or sleeve-type coupling in the pit to permit removal.

Mechanical-end valves 3 through 10 inches in diameter may be direct burial if provided with a suitable valve box, means for manual operation, and an

adjacent pipe joint to facilitate valve removal. Valve operators shall restrict closing to a rate requiring approximately 60 seconds, from fully open to fully closed.

#### 2.4.3 Vacuum and Air Relief Valves

Vacuum and air relief valves shall be of the size shown and shall be of a type that will release air and prevent the formation of a vacuum. The valves shall automatically release air when the lines are being filled with water and shall admit air into the line when water is being withdrawn in excess of the inflow. Valves shall be iron body with bronze trim and stainless steel float.

#### 2.4.4 Indicator Post for Valves

Each valve shown on the drawings with the designation "P.I.V." shall be equipped with indicator post conforming to the requirements of NFPA 24. Operation shall be by a wrench which shall be attached to each post.

### 2.5 VALVE BOXES

Valve boxes shall be cast iron or concrete, except that concrete boxes may be installed only in locations not subjected to vehicular traffic. Cast-iron boxes shall be extension type with slide-type adjustment and with flared base. The minimum thickness of metal shall be 3/16 inch. The word "WATER" shall be cast in the cover. The box length shall adapt, without full extension, to the depth of cover required over the pipe at the valve location.

### 2.6 VALVE PITS

Valve pits shall be constructed at locations indicated or as required above and in accordance with the details shown. Concrete shall have compressive strength of 3000 psi in accordance with Section 03300CAST-IN-PLACE STRUCTURAL CONCRETE.

### 2.7 FIRE HYDRANTS

Hydrants shall be dry-barrel type conforming to AWWA C502 with valve opening at least 5 inches in diameter and designed so that the flange at the main valve seat can be removed with the main valve seat apparatus remaining intact, closed and reasonably tight against leakage and with a breakable valve rod coupling and breakable flange connections located no more than 8 inches above the ground grade. Hydrants shall have a 6 inch bell connection, two 2-1/2 inch hose connections and one 4-1/2 inch pumper connection. Outlets shall have American National Standard fire-hose coupling threads. Working parts shall be bronze. Design, material, and workmanship shall be equal to the latest stock pattern ordinarily produced by the manufacturer. Hydrants shall be painted with 1 coat of red iron oxide, zinc oxide primer conforming to SSPC Paint 25 and 2 finish coats of silicone alkyd paint conforming to SSPC Paint 21, of the installation's standard colors or as directed by the Contracting Officer

### 2.8 MISCELLANEOUS ITEMS

#### 2.8.1 Service Clamps

Service clamps shall have a pressure rating not less than that of the pipe to be connected and shall be either the single or double flattened strap

type. Clamps shall have a galvanized malleable-iron body with cadmium plated straps and nuts. Clamps shall have a rubber gasket cemented to the body.

#### 2.8.2 Corporation Stops

Corporation stops shall have standard corporation stop thread conforming to AWWA C800 on the inlet end, with flanged joints, compression pattern flared tube couplings, or wiped joints for connections to goosenecks.

#### 2.8.3 Service Stops

Service stops shall be water-works inverted-ground-key type, oval or round flow way, tee handle, without drain. Pipe connections shall be suitable for the type of service pipe used. All parts shall be of bronze with female iron-pipe-size connections or compression-pattern flared tube couplings, and shall be designed for a hydrostatic test pressure not less than 200 psi.

#### 2.8.4 Tapping Sleeves

Tapping sleeves of the sizes indicated for connection to existing main shall be the cast gray, ductile, or malleable iron, split-sleeve type with flanged or grooved outlet, and with bolts, follower rings and gaskets on each end of the sleeve. Construction shall be suitable for a maximum working pressure of 150 psi. Bolts shall have square heads and hexagonal nuts. Longitudinal gaskets and mechanical joints with gaskets shall be as recommended by the manufacturer of the sleeve. When using grooved mechanical tee, it shall consist of an upper housing with full locating collar for rigid positioning which engages a machine-cut hole in pipe, encasing an elastomeric gasket which conforms to the pipe outside diameter around the hole and a lower housing with positioning lugs, secured together during assembly by nuts and bolts as specified, pretorqued to 50 foot-pound.

#### 2.8.5 Service Boxes

Service boxes shall be cast iron or concrete and shall be extension service boxes of the length required for the depth of the line, with either screw or slide-type adjustment. The boxes shall have housings of sufficient size to completely cover the service stop or valve and shall be complete with identifying covers.

#### 2.8.6 Disinfection

Chlorinating materials shall conform to the following:

Chlorine, Liquid: AWWA B301.

Hypochlorite, Calcium and Sodium: AWWA B300.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

##### 3.1.1 Cutting of Pipe

Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise recommended by the manufacturer and authorized by the Contracting Officer, cutting shall be done with an

approved type mechanical cutter. Wheel cutter shall be used when practicable. Copper tubing shall be cut square and all burrs shall be removed. Squeeze type mechanical cutters shall not be used for ductile iron.

### 3.1.2 Adjacent Facilities

#### 3.1.2.1 Sewer Lines

Where the location of the water pipe is not clearly defined in dimensions on the drawings, the water pipe shall not be laid closer horizontally than 10 feet from a sewer except where the bottom of the water pipe will be at least 12 inches above the top of the sewer pipe, in which case the water pipe shall not be laid closer horizontally than 6 feet from the sewer. Where water lines cross under gravity-flow sewer lines, the sewer pipe, for a distance of at least 10 feet each side of the crossing, shall be fully encased in concrete or shall be made of pressure pipe with no joint located within 3 feet horizontally of the crossing. Water lines shall in all cases cross above sewage force mains or inverted siphons and shall be not less than 2 feet above the sewer main. Joints in the sewer main, closer horizontally than 3 feet to the crossing, shall be encased in concrete.

#### 3.1.2.2 Water Lines

Water lines shall not be laid in the same trench with sewer lines, gas lines, fuel lines, or electric wiring.

### 3.1.3 Joint Deflection

#### 3.1.3.1 Offset for Flexible Plastic Pipe

Maximum offset in alignment between adjacent pipe joints shall be as recommended by the manufacturer and approved by the Contracting Officer, but shall not exceed 5 degrees.

### 3.1.4 Placing and Laying

Pipe and accessories shall be carefully lowered into the trench by means of derrick, ropes, belt slings, or other authorized equipment. Water-line materials shall not be dropped or dumped into the trench. Abrasion of the pipe coating shall be avoided. Except where necessary in making connections with other lines or as authorized by the Contracting Officer, pipe shall be laid with the bells facing in the direction of laying. The full length of each section of pipe shall rest solidly upon the pipe bed, with recesses excavated to accommodate bells, couplings, and joints. Pipe that has the grade or joint disturbed after laying shall be taken up and relaid. Pipe shall not be laid in water or when trench conditions are unsuitable for the work. Water shall be kept out of the trench until joints are complete. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so that no trench water, earth, or other substance will enter the pipes or fittings. Where any part of the coating or lining is damaged, the repair shall be made by and at the Contractor's expense in a satisfactory manner. Pipe ends left for future connections shall be valved, plugged, or capped, and anchored, as shown.

#### 3.1.4.1 Plastic Pipe Installation

PE Pipe shall be installed in accordance with ASTM D 2774. PVC pipe shall be installed in accordance with AWWA M23.

### 3.1.4.2 Piping Connections

Where connections are made between new work and existing mains, the connections shall be made by using specials and fittings to suit the actual conditions. When made under pressure, these connections shall be installed using standard methods as approved by the Contracting Officer. Connections to existing asbestos-cement pipe shall be made in accordance with ACPPA Work Practices.

### 3.1.4.3 Penetrations

Pipe passing through walls of valve pits and structures shall be provided with ductile-iron or Schedule 40 steel wall sleeves. Annular space between walls and sleeves shall be filled with rich cement mortar. Annular space between pipe and sleeves shall be filled with mastic.

### 3.1.4.4 Flanged Pipe

Flanged pipe shall only be installed above ground or with the flanges in valve pits.

### 3.1.5 Jointing

#### 3.1.5.1 PE Pipe Requirements

Jointing shall comply with ASTM D 2657, Technique I-Socket Fusion or Technique II-Butt Fusion.

#### 3.1.5.2 PVC Plastic Pipe Requirements

- a. Pipe less than 4 inch diameter: Threaded joints shall be made by wrapping the male threads with approved thread tape or applying an approved lubricant, then threading the joining members together. The joint shall be tightened using strap wrenches to prevent damage to the pipe and/or fitting. To avoid excessive torque, joints shall be tightened no more than one thread past hand-tight. Preformed rubber-ring gaskets for elastomeric-gasket joints shall be made in accordance with ASTM F 477 and as specified. Pipe ends for push-on joints shall be beveled to facilitate assembly and marked to indicate when the pipe is fully seated. The gasket shall be prelubricated to prevent displacement. The gasket and ring groove in the bell or coupling shall match. The manufacturer of the pipe or fitting shall supply the elastomeric gasket. Couplings shall be provided with stops or centering rings to assure that the coupling is centered on the joint. Solvent cement joints shall use sockets conforming to ASTM D 2467. The solvent cement used shall meet the requirements of ASTM D 2564; the joint assembly shall be made in accordance with ASTM D 2855 and the manufacturer's specific recommendations.
- b. Pipe 4 through 12 inch diameter: Joints shall be elastomeric gasket as specified in AWWA C900. Jointing procedure shall be as specified for pipe less than 4 inch diameter with configuration using elastomeric ring gasket.

#### 3.1.5.3 Bonded Joints Requirements

Bonded joints shall be installed in accordance with details specified for

joints in paragraph JOINTS.

#### 3.1.5.4 Isolation Joints and Dielectric Fittings

Isolation joints and dielectric fittings shall be installed in accordance with details specified in paragraph JOINTS. Dielectric unions shall be encapsulated in a field-poured coal-tar covering, with at least 1/8 inch thickness of coal tar over all fitting surfaces.

#### 3.1.5.5 Transition Fittings

Connections between different types of pipe and accessories shall be made with transition fittings approved by the Contracting Officer.

#### 3.1.6 Installation of Service Lines

Service lines shall include the pipeline connecting building piping to water distribution lines to the connections with the building service at a point approximately 5 feet outside the building where such building service exists. Where building services are not installed, the Contractor shall terminate the service lines approximately 5 feet from the site of the proposed building at a point designated by the Contracting Officer. Such service lines shall be closed with plugs or caps. All service stops and valves shall be provided with service boxes. Service lines shall be constructed in accordance with the following requirements:

##### 3.1.6.1 Service Lines Larger than 2 Inches

Service lines larger than 2 inches shall be connected to the main by a tapped saddle, tapping sleeve and valve, service clamp or reducing tee, depending on the main diameter and the service line diameter, and shall have a gate valve.

##### 3.1.6.2 Service Lines for Sprinkler Supplies

Water service lines used to supply building sprinkler systems for fire protection shall be connected to the water distribution main in accordance with NFPA 24.

#### 3.1.7 Setting of Fire Hydrants, Valves and Valve Boxes

##### 3.1.7.1 Location of Fire Hydrants

Fire hydrants shall be located and installed as shown. Each hydrant shall be connected to the main with a 6 inch branch line having at least as much cover as the distribution main. Hydrants shall be set plumb with pumper nozzle facing the roadway, with the center of the lowest outlet not less than 18 inches above the finished surrounding grade, and the operating nut not more than 48 inches above the finished surrounding grade. Except where approved otherwise, the backfill around hydrants shall be thoroughly compacted to the finished grade immediately after installation to obtain beneficial use of the hydrant as soon as practicable. The hydrant shall be set upon a slab of concrete not less than 4 inches thick and 15 inches square. Not less than 7 cubic feet of free-draining broken stone or gravel shall be placed around and beneath the waste opening of dry barrel hydrants to ensure drainage.

##### 3.1.7.2 Location of Valves

After delivery, valves, including those in hydrants, shall be drained to prevent freezing and shall have the interiors cleaned of all foreign matter before installation. Stuffing boxes shall be tightened and hydrants and valves shall be fully opened and fully closed to ensure that all parts are in working condition. Valves and valve boxes shall be installed where shown or specified, and shall be set plumb. Valve boxes shall be centered on the valves. Boxes shall be installed over each outside gate valve unless otherwise shown. Where feasible, valves shall be located outside the area of roads and streets. Earth fill shall be tamped around each valve box or pit to a distance of 4 feet on all sides of the box, or the undisturbed trench face if less than 4 feet.

#### 3.1.7.3 Location of Service Boxes

Where water lines are located below paved streets having curbs, the boxes shall be installed directly back of the curbs. Where no curbing exists, service boxes shall be installed in accessible locations, beyond the limits of street surfacing, walks and driveways.

#### 3.1.8 Thrust Restraint

Plugs, caps, tees and bends deflecting 11.25 degrees or more, either vertically or horizontally, on waterlines 4 inches in diameter or larger, and fire hydrants shall be provided with thrust restraints. Valves shall be securely anchored or shall be provided with thrust restraints to prevent movement. Thrust restraints shall be either thrust blocks or, for ductile-iron pipes, restrained joints.

##### 3.1.8.1 Thrust Blocks

Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 2,000 psi after 28 days. Blocking shall be placed between solid ground and the hydrant or fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of thrust blocks shall be poured directly against undisturbed earth. The sides of thrust blocks not subject to thrust may be poured against forms. The area of bearing shall be as shown or as directed. Blocking shall be placed so that the fitting joints will be accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

##### 3.1.8.2 Restrained Joints

For ductile-iron pipe, restrained joints shall be designed by the Contractor or the pipe manufacturer in accordance with DIPRA-Restraint Design.

#### 3.2 HYDROSTATIC TESTS

Where any section of a water line is provided with concrete thrust blocking for fittings or hydrants, the hydrostatic tests shall not be made until at least 5 days after installation of the concrete thrust blocking, unless otherwise approved.

##### 3.2.1 Pressure Test

After the pipe is laid, the joints completed, fire hydrants permanently installed, and the trench partially backfilled leaving the joints exposed

for examination, the newly laid piping or any valved section of piping shall, unless otherwise specified, be subjected for 1 hour to a hydrostatic pressure test of 200 psi. Each valve shall be opened and closed several times during the test. Exposed pipe, joints, fittings, hydrants, and valves shall be carefully examined during the partially open trench test. Joints showing visible leakage shall be replaced or remade as necessary. Cracked or defective pipe, joints, fittings, hydrants and valves discovered in consequence of this pressure test shall be removed and replaced with sound material, and the test shall be repeated until the test results are satisfactory. The requirement for the joints to remain exposed for the hydrostatic tests may be waived by the Contracting Officer when one or more of the following conditions is encountered:

- a. Wet or unstable soil conditions in the trench.
- b. Compliance would require maintaining barricades and walkways around and across an open trench in a heavily used area that would require continuous surveillance to assure safe conditions.
- c. Maintaining the trench in an open condition would delay completion of the project.

The Contractor may request a waiver, setting forth in writing the reasons for the request and stating the alternative procedure proposed to comply with the required hydrostatic tests. Backfill placed prior to the tests shall be placed in accordance with the requirements of Section 02316a EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

### 3.2.2 Leakage Test

Leakage test shall be conducted after the pressure tests have been satisfactorily completed. The duration of each leakage test shall be at least 2 hours, and during the test the water line shall be subjected to not less than 200 psi pressure. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section, necessary to maintain pressure within 5 psi of the specified leakage test pressure after the pipe has been filled with water and the air expelled. Piping installation will not be accepted if leakage exceeds the allowable leakage which is determined by the following formula:

$$L = 0.0001351ND(P \text{ raised to } 0.5 \text{ power})$$

L = Allowable leakage in gallons per hour

N = Number of joints in the length of pipeline tested

D = Nominal diameter of the pipe in inches

P = Average test pressure during the leakage test, in psi gauge

Should any test of pipe disclose leakage greater than that calculated by the above formula, the defective joints shall be located and repaired until the leakage is within the specified allowance, without additional cost to the Government.

### 3.2.3 Time for Making Test

Except for joint material setting or where concrete thrust blocks necessitate a 5-day delay, pipelines jointed with rubber gaskets, mechanical or push-on joints, or couplings may be subjected to hydrostatic pressure, inspected, and tested for leakage at any time after partial completion of backfill. Cement-mortar lined pipe may be filled with water

as recommended by the manufacturer before being subjected to the pressure test and subsequent leakage test.

#### 3.2.4 Concurrent Hydrostatic Tests

The Contractor may elect to conduct the hydrostatic tests using either or both of the following procedures. Regardless of the sequence of tests employed, the results of pressure tests, leakage tests, and disinfection shall be as specified. Replacement, repair or retesting required shall be accomplished by the Contractor at no additional cost to the Government.

- a. Pressure test and leakage test may be conducted concurrently.
- b. Hydrostatic tests and disinfection may be conducted concurrently, using the water treated for disinfection to accomplish the hydrostatic tests. If water is lost when treated for disinfection and air is admitted to the unit being tested, or if any repair procedure results in contamination of the unit, disinfection shall be reaccomplished.

### 3.3 BACTERIOLOGICAL DISINFECTION

#### 3.3.1 Bacteriological Disinfection

Before acceptance of potable water operation, each unit of completed waterline shall be disinfected as specified. After pressure tests have been made, the unit to be disinfected shall be thoroughly flushed with water until all entrained dirt and mud have been removed before introducing the chlorinating material. The chlorinating material shall be either liquid chlorine, calcium hypochlorite, or sodium hypochlorite, conforming to paragraph MISCELLANEOUS ITEMS. The chlorinating material shall provide a dosage of not less than 50 ppm and shall be introduced into the water lines in an approved manner. Polyvinyl Chloride (PVC) pipe lines shall be chlorinated using only the above specified chlorinating material in solution. The agent shall not be introduced into the line in a dry solid state. The treated water shall be retained in the pipe long enough to destroy all non-spore forming bacteria. Except where a shorter period is approved, the retention time shall be at least 24 hours and shall produce not less than 25 ppm of free chlorine residual throughout the line at the end of the retention period. Valves on the lines being disinfected shall be opened and closed several times during the contact period. The line shall then be flushed with clean water until the residual chlorine is reduced to less than 1.0 ppm. During the flushing period, each fire hydrant on the line shall be opened and closed several times. From several points in the unit, personnel from the Contractor's commercial laboratory shall take at least 3 water samples from different points, approved by the Contracting Officer, in proper sterilized containers and perform a bacterial examination in accordance with state approved methods. The commercial laboratory shall be certified by the state's approving authority for examination of potable water. The disinfection shall be repeated until tests indicate the absence of pollution for at least 2 full days. The unit will not be accepted until satisfactory bacteriological results have been obtained.

### 3.4 CLEANUP

Upon completion of the installation of water lines, and appurtenances, all debris and surplus materials resulting from the work shall be removed.

-- End of Section --

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SECTION 02531A

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## SECTION 02531A

## SANITARY SEWERS AND DRAINAGE PIPES

04/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 33	(2001a) Concrete Aggregates
ASTM C 94/C 94M	(2000) Ready-Mixed Concrete
ASTM C 150	(2002) Portland Cement
ASTM C 260	(2001) Air-Entraining Admixtures for Concrete
ASTM C 270	(2001) Mortar for Unit Masonry
ASTM C 443	(1998) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM C 478	(1997) Precast Reinforced Concrete Manhole Sections
ASTM C 972	(2000) Compression-Recovery of Tape Sealant
ASTM D 412	(1998a) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension
ASTM D 624	(2000) Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM D 1784	(1999a) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 2680	(2001) Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping
ASTM D 2751	(1996a) Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
ASTM D 3034	(2000) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings

ASTM D 3212	(1996a) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 3350	(1999) Polyethylene Plastics Pipe and Fittings Materials
ASTM F 402	(1993; R 1999) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings
ASTM F 714	(2000) Polyethylene (PE) Plastic pipe (SDR-PR) Based on Outside Diameter
ASTM F 794	(1999) Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
ASTM F 894	(1998a) Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
ASTM F 949	(2001) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 49	(1994) Hazardous Chemicals Data
NFPA 325-1	(1994) Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids
NFPA 704	(2001) Identification of the Hazards of Materials for Emergency Response

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-9	(1990; Addenda 1994) Recommended Performance Specification for Polyvinyl Chloride (PVC) Profile Wall Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter (Nominal Pipe Sizes 4-48 inch)
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## 1.2 GENERAL REQUIREMENTS

The construction required herein shall include appurtenant structures and building sewers to points of connection with the building drains 5 feet outside the building to which the sewer system is to be connected. The construction required herein shall also apply to ponds' drainage system. The Contractor shall replace damaged material and redo unacceptable work at no additional cost to the Government. Excavation and backfilling is specified in Section 02316a EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Backfilling shall be accomplished after inspection by the Contracting Officer. Force mains are specified in Section 02532a FORCE MAINS AND INTAKE WATER DISTRIBUTION. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions

available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install the plastic pipe shall be stored in accordance with the manufacturer's recommendation and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### SD-07 Certificates

##### Portland Cement;

Certificates of compliance stating the type of cement used in manufacture of concrete pipe, fittings and precast manholes.

##### Joints;

## PART 2 PRODUCTS

### 2.1 PIPE

Pipe shall conform to the respective specifications and other requirements specified below.

#### 2.1.1 Plastic Pipe

Acrylonitrile-butadiene-styrene (ABS) and polyvinyl chloride (PVC) composite sewer piping shall conform to ASTM D 2680. Size 8 inch through 12 inch diameter.

##### 2.1.1.1 ABS Pipe

ASTM D 2751.

##### 2.1.1.2 PVC Pipe

ASTM D 3034, Type PSM with a maximum SDR of 35, Size 12 inches or less in diameter. ASTM F 949 for corrugated sewer pipes with a smooth interior. PVC shall be certified by the compounder as meeting the requirements of ASTM D 1784, cell Class 12454B. The pipe stiffness shall be greater than or equal to 735/D for cohesionless material pipe trench backfills.

##### 2.1.1.3 High Density Polyethylene Pipe

ASTM F 894, Class 63, size 14 inch through 120 inch. ASTM F 714, size 4 inch through 48 inch. The polyethylene shall be certified by the resin producer as meeting the requirements of ASTM D 3350, cell Class 334433C. The pipe stiffness shall be greater than or equal to 1170/D for cohesionless material pipe trench backfills.

### 2.2 REQUIREMENTS FOR FITTINGS

Fittings shall be compatible with the pipe supplied and shall have a strength not less than that of the pipe. Fittings shall conform to the respective specifications and other requirements specified below.

#### 2.2.1 Fittings for Plastic Pipe

ABS and PVC composite sewer pipe fittings shall conform to ASTM D 2680.

##### 2.2.1.1 Fittings for ABS Pipe

ASTM D 2751.

##### 2.2.1.2 Fittings for PVC Pipe

ASTM D 3034 for type PSM pipe. ASTM F 949 for corrugated sewer pipe with a smooth interior. UBPPA UNI-B-9 and ASTM F 794, Series 46, for ribbed sewer pipe with smooth interior.

##### 2.2.1.3 Fittings for High Density Polyethylene Pipe

ASTM F 894.

#### 2.3 JOINTS

Joints installation shall comply with the manufacturer's instructions. Fittings and gaskets utilized for waste drains or industrial waste lines shall be certified by the manufacturer as oil resistant.

##### 2.3.1 Plastic Pipe Jointing

Flexible plastic pipe (PVC or high density polyethylene pipe) gasketed joints shall conform to ASTM D 3212.

###### 2.3.1.1 ABS Pipe Jointing

ASTM D 2751, solvent weld or bell and spigot O-ring joint, size 12 inches or less in diameter, dimensions and tolerances in accordance with Table 2 of ASTM D 2751.

###### 2.3.1.2 High Density Polyethylene Pipe Jointing

Rubber gasket joints shall conform to ASTM C 443.

#### 2.4 BRANCH CONNECTIONS

Branch connections shall be made by use of regular fittings or solvent cemented saddles as approved. Saddles for ABS and PVC composite pipe shall conform to Figure 2 of ASTM D 2680; saddles for ABS pipe shall comply with Table 3 of ASTM D 2751; and saddles for PVC pipe shall conform to Table 4 of ASTM D 3034.

#### 2.5 FRAMES AND COVERS

Frames and covers shall be cast iron, or ductile iron. Cast iron frames and covers shall be as indicated or shall be of type suitable for the application, circular, without vent holes. The frames and covers shall have a combined weight of not less than 400 pounds. The word "Sewer" shall be stamped or cast into covers so that it is plainly visible.

## 2.6 MANHOLE STEPS

Manhole Steps shall be copolymer polypropylene plastic in conformance with ASTM C 478.

## 2.7 CEMENT MORTAR

Cement mortar shall conform to ASTM C 270, Type M with Type II cement.

### 2.7.1 Portland Cement

Portland cement shall conform to ASTM C 150, Type V for concrete used in manholes, concrete cradle, concrete encasement, and thrust blocking. Air-entraining admixture conforming to ASTM C 260 shall be used with Type V cement. Where aggregates are alkali reactive, as determined by Appendix XI of ASTM C 33, a cement containing less than 0.60 percent alkalies shall be used.

### 2.7.2 Portland Cement Concrete

Portland cement concrete shall conform to ASTM C 94/C 94M, compressive strength of 4000 psi at 28 days, except for concrete cradle and encasement or concrete blocks for manholes. Concrete used for cradle and encasement shall have a compressive strength of 2500 psiminimum at 28 days. Concrete in place shall be protected from freezing and moisture loss for 7 days.

## 2.8 STRUCTURES

### 2.8.1 Precast Reinforced Concrete Manhole Sections

Precast reinforced concrete manhole sections shall conform to ASTM C 478, except that portland cement shall be as specified herein. Joints shall be cement mortar, an approved mastic, rubber gaskets, a combination of these types; or the use of external preformed rubber joint seals and extruded rolls of rubber with mastic adhesive on one side.

## PART 3 EXECUTION

### 3.1 INSTALLATION

#### 3.1.1 Adjacent Facilities

##### 3.1.1.1 Water Lines

Where the location of the sewer is not clearly defined by dimensions on the drawings, the sewer shall not be closer horizontally than 10 feet to a water-supply main or service line, except that where the bottom of the water pipe will be at least 12 inches above the top of the sewer pipe, the horizontal spacing may be a minimum of 6 feet. Where gravity-flow sewers cross above water lines, the sewer pipe for a distance of 10 feet on each side of the crossing shall be fully encased in concrete or shall be acceptable pressure pipe with no joint closer horizontally than 3 feet to the crossing. The thickness of the concrete encasement including that at the pipe joints shall be not less than 4 inches.

#### 3.1.2 Pipe Laying

- a. Pipe shall be protected during handling against impact shocks and

free fall; the pipe interior shall be free of extraneous material.

- b. Pipe laying shall proceed upgrade with the spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow. Each pipe shall be laid accurately to the line and grade shown on the drawings. Pipe shall be laid and centered so that the sewer has a uniform invert. As the work progresses, the interior of the sewer shall be cleared of all superfluous materials.
- c. Before making pipe joints, all surfaces of the portions of the pipe to be joined shall be clean and dry. Lubricants, primers, and adhesives shall be used as recommended by the pipe manufacturer. The joints shall then be placed, fitted, joined, and adjusted to obtain the degree of water tightness required.
- d. ABS composite pipe ends with exposed truss and filler material shall be coated with solvent weld material before making the joint to prevent water or air passage at the joint between the inner and outer wall of the pipe.
- e. Installations of solvent weld joint pipe, using ABS or PVC pipe and fittings shall be in accordance with ASTM F 402. The Contractor shall ensure adequate trench ventilation and protection for workers installing the pipe.

#### 3.1.2.1 Caulked Joints

The packing material shall be well packed into the annular space to prevent the entrance of lead into the pipe. The remainder of the space shall be filled with molten lead that is hot enough to show a rapid change in color when stirred. Scum shall be removed before pouring. The lead shall be caulked to form a tight joint without overstraining the bell and shall have a minimum depth of 1 inch after caulking.

#### 3.1.2.2 Trenches

Trenches shall be kept free of water and as dry as possible during bedding, laying, and jointing and for as long a period as required. When work is not in progress, open ends of pipe and fittings shall be satisfactorily closed so that no trench water or other material will enter the pipe or fittings.

#### 3.1.2.3 Backfill

As soon as possible after the joint is made, sufficient backfill material shall be placed along the pipe to prevent pipe movement off line or grade. Plastic pipe shall be completely covered to prevent damage from ultraviolet light.

#### 3.1.2.4 Width of Trench

If the maximum width of the trench at the top of the pipe, as specified in Section 02316a EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS, is exceeded for any reason other than by direction, the Contractor shall install, at no additional cost to the Government, concrete cradling, pipe encasement, or other bedding required to support the added load of the backfill.

### 3.1.2.5 Jointing

Joints between different pipe materials shall be made as specified, using approved jointing materials.

### 3.1.2.6 Handling and Storage

Pipe, fittings and joint material shall be handled and stored in accordance with the manufacturer's recommendations. Storage facilities for plastic pipe, fittings, joint materials and solvents shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49 and NFPA 325-1.

### 3.1.3 Leakage Tests

Lines shall be tested for leakage by infiltration tests or exfiltration tests, as appropriate. Prior to infiltration or exfiltration tests, the trench shall be backfilled up to at least the lower half of the pipe. If required, sufficient additional backfill shall be placed to prevent pipe movement during testing, leaving the joints uncovered to permit inspection.

Visible leaks encountered shall be corrected regardless of leakage test results. When the water table is 2 feet or more above the top of the pipe at the upper end of the pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to the Contracting Officer. When the Contracting Officer determines that infiltration cannot be properly tested, an exfiltration test shall be made by filling the line to be tested with water so that a head of at least 2 feet is provided above both the water table and the top of the pipe at the upper end of the pipeline to be tested. The filled line shall be allowed to stand until the pipe has reached its maximum absorption, but not less than 4 hours. After absorption, the head shall be re-established. The amount of water required to maintain this water level during a 2-hour test period shall be measured. Leakage as measured by either the infiltration test or exfiltration test shall not exceed 25 gal per inch diameter per mile of pipeline per day. When leakage exceeds the maximum amount specified, satisfactory correction shall be made and retesting accomplished. Testing, correction, and retesting shall be made at no additional cost to the Government.

### 3.1.4 Test for Deflection

When flexible pipe is used, a deflection test shall be made on the entire length of the installed pipeline not less than 30 days after the completion of all work including the leakage test, backfill, and placement of any fill, grading, paving, concrete, or superimposed loads. Deflection shall be determined by use of a deflection device or by use of a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. The ball, cylinder, or circular sections shall have a diameter, or minor diameter as applicable, of 92.5 percent of the inside diameter of the pipe. A tolerance of plus 0.5 percent will be permitted. The ball, cylinder, or circular sections shall be of a homogeneous material throughout, shall have a density greater than 1.0 as related to water at 39.2 degrees F, and shall have a surface brinell hardness of not less than 150. The device shall be center bored and through bolted with a 1/4 inch minimum diameter steel shaft having a yield strength of 70,000 psi or more, with eyes at each end for attaching pulling cables. The eye shall be suitably backed with flange or heavy washer; a pull exerted on the opposite end of the shaft shall produce compression throughout the remote end of the ball, cylinder or circular section. Circular sections shall be spaced so

that the distance from the external faces of the front and back sections shall equal or exceed the diameter of the circular section. Failure of the ball, cylinder, or circular section to pass freely through a pipe run, either by being pulled through or by being flushed through with water, shall be cause for rejection of that run. When a deflection device is used for the test in lieu of the ball, cylinder, or circular sections described, such device shall be approved prior to use. The device shall be sensitive to 1.0 percent of the diameter of the pipe being measured and shall be accurate to 1.0 percent of the indicated dimension. Installed pipe showing deflections greater than 7.5 percent of the normal diameter of the pipe, shall be retested by a run from the opposite direction. If the retest also fails, the suspect pipe shall be replaced at no cost to the Government.

### 3.2 INSTALLATION OF WYE BRANCHES

Wye branches shall be installed where sewer connections and ponds' drainage connections are indicated or where directed. Cutting into piping for connections shall not be done except in special approved cases. When the connecting pipe cannot be adequately supported on undisturbed earth or tamped backfill, the pipe shall be encased in concrete backfill or supported on a concrete cradle as directed. Concrete required because of conditions resulting from faulty construction methods or negligence by the Contractor shall be installed at no additional cost to the Government. The installation of wye branches in an existing sewer shall be made by a method which does not damage the integrity of the existing sewer. One acceptable method consists of removing one pipe section, breaking off the upper half of the bell of the next lower section and half of the running bell of wye section. After placing the new section, it shall be rotated so that the broken half of the bell will be at the bottom. The two joints shall then be made with joint packing and cement mortar.

### 3.3 MANHOLE DETAILS

#### 3.3.1 General Requirements

Manholes shall be constructed of precast concrete manhole sections. The invert channels shall be smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. The invert channels shall be formed directly in the concrete of the manhole base, or shall be built up with brick and mortar, or shall be half tile laid in concrete, or shall be constructed by laying full section sewer pipe through the manhole and breaking out the top half after the surrounding concrete has hardened. Pipe connections shall be made to manhole using water stops, standard O-ring joints, special manhole coupling, or shall be made in accordance with the manufacturer's recommendation. The Contractor's proposed method of connection, list of materials selected, and specials required, shall be approved prior to installation. The floor of the manhole outside the channels shall be smooth and shall slope toward the channels not less than 1 inch per foot nor more than 2 inches per foot. Free drop inside the manholes shall not exceed 18 inches, measured from the invert of the inlet pipe to the top of the floor of the manhole outside the channels; drop manholes shall be constructed whenever the free drop would otherwise be greater than 1 foot 6 inches.

#### 3.3.2 Jointing, Plastering and Sealing

Mortar joints shall be completely filled and shall be smooth and free from surplus mortar on the inside of the manhole. Mortar and mastic joints between precast rings shall be full-bedded in jointing compound and shall be smoothed to a uniform surface on both the interior and exterior of the manhole. Installation of rubber gasket joints between precast rings shall be in accordance with the recommendations of the manufacturer. Precast rings may also be sealed by the use of extruded rolls of rubber with mastic adhesive on one side.

### 3.3.3 Setting of Frames and Covers

Unless otherwise indicated, tops of frames and covers shall be set flush with finished grade in paved areas or 2 inches higher than finished grade in unpaved areas. Frame and cover assemblies shall be sealed to manhole sections using external preformed rubber joint seals that meet the requirements of ASTM D 412 and ASTM D 624, or other methods specified in paragraph Jointing, Plastering and Sealing, unless otherwise specified.

### 3.3.4 External Preformed Rubber Joint Seals

External preformed rubber joint seals and extruded rolls of rubber with mastic adhesive shall meet the requirements of ASTM D 412 and ASTM C 972 to ensure conformance with paragraph Leakage Tests. The seal shall be multi-section with neoprene rubber top section and all lower sections made of Ethylene Propylene Di Monomer (EPDM) rubber with a minimum thickness of 60 mils. Each unit shall consist of a top and a bottom section and shall have mastic on the bottom of the bottom section and mastic on the top and bottom of the top section. The mastic shall be non-hardening butyl rubber sealant and shall seal to the cone/top slab of the manhole/catch basin and over the lip of the casting. One unit shall seal a casting and up to six, 2 inch adjusting rings. The bottom section shall be 12 inches in height. A 6 inch high top section will cover up to two, 2 inch adjusting rings. A 12 inch high bottom section will cover up to six, 2 inch adjusting rings. Extension sections shall cover up to two more adjusting rings. Each extension shall overlap the bottom section by 2 inches and shall be overlapped by the top section by 2 inches.

## 3.4 CONNECTING TO EXISTING MANHOLES

Pipe connections to existing manholes shall be made so that finish work will conform as nearly as practicable to the applicable requirements specified for new manholes, including all necessary concrete work, cutting, and shaping. The connection shall be centered on the manhole. Holes for the new pipe shall be of sufficient diameter to allow packing cement mortar around the entire periphery of the pipe but no larger than 1.5 times the diameter of the pipe. Cutting the manhole shall be done in a manner that will cause the least damage to the walls.

## 3.5 BUILDING CONNECTIONS

Building connections shall include the lines to and connection with the building waste drainage piping at a point approximately 5 feet outside the building, unless otherwise indicated. Where building drain piping is not installed, the Contractor shall terminate the building connections approximately 5 feet from the site of the building at a point and in a manner designated.

## 3.6 CLEANOUTS AND OTHER APPURTENANCES

Cleanouts and other appurtenances shall be installed where shown on the drawings or as directed by the Contracting Officer, and shall conform to the detail of the drawings.

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SECTION 02532A

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07/98

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## SECTION 02532A

FORCE MAINS; INTAKE WATER DISTRIBUTION  
07/98

## PART 1 GENERAL

This specification shall govern the installation of supply piping for the rearing ponds and the supply piping from the existing pumphouse to the hatchery process water supply connection.

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN PETROLEUM INSTITUTE (API)

API Spec 6D (2002) Pipeline Valves

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2122 (1998) Determining Dimensions of Thermoplastic Pipe and Fittings

ASTM D 2657 (1997) Heat Fusion Joining Polyolefin Pipe and Fittings

ASTM D 2774 (2001) Underground Installation of Thermoplastic Pressure Piping

ASTM D 3035 (2001) Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter

ASTM D 3350 (2002) Polyethylene Plastics Pipe and Fittings Materials

ASTM D 4101 (2002) Polypropylene Plastic Injection and Extrusion Materials

## ASME INTERNATIONAL (ASME)

ASME B16.1 (1998) Cast Iron Pipe Flanges and Flanged Fittings

## MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-78 (1998) Cast Iron Plug Valves, Flanged and Threaded Ends

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation;

submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Hydrostatic Tests; G-AO

Copies of test results.

1.3 DELIVERY AND STORAGE

Pipe, fittings and accessories, and pipe coatings shall not be damaged during delivery, handling, and storage.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

Piping for force mains less than 4 inches in diameter shall be polyethylene (PE) plastic or polypropylene plastic. Piping for force mains 4 inches in diameter and larger shall be , Polyethylene (PE) plastic, . Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 Plastic Pipe

2.1.1.1 PE Pipe

ASTM D 3350 and ASTM D 3035, minimum pressure rating of 75 psi at 73.4 degrees F.

2.1.1.2 Polypropylene Pipe

ASTM D 2122 and ASTM D 4101.

2.2 JOINTS

2.2.1 PE Piping

a. Heat Fusion Joints: ASTM D 2657.

b. Mechanical Joints: ASME B16.1.

2.2.2 Polypropylene Piping

Heat Fusion Joints: ASTM D 2657.

2.3 VALVES

2.3.1 Rubber-Seated Butterfly Valves

Rubber-seated butterfly valves shall conform to the performance requirements of AWWA C504. Wafer type valves conforming to the performance requirements of AWWA C504 in all respects, but not meeting laying length requirements will be acceptable if supplied and installed with a spacer providing the specified laying length. All tests required by AWWA C504 shall be met. Flanged-end valves shall be installed in an approved pit and provided with a union or sleeve-type coupling in the pit to permit removal.

Mechanical-end valves 3 through 10 inches in diameter may be direct burial if provided with a suitable valve box, means for manual operation, and an adjacent pipe joint to facilitate valve removal. Valve operators shall restrict closing to a rate requiring approximately 60 seconds, from fully open to fully closed.

#### 2.3.2 Plug Valves

Cast iron valves shall comply with MSS SP-78. Steel plug valves shall comply with API Spec 6D.

#### 2.4 VALVE BOXES

Valve boxes shall be cast iron. Cast iron boxes shall be the extension type with slide type adjustment and with flared base. The minimum thickness of metal shall be 3/16 inch. The box length shall be adaptable, without full extension, to the depth of cover over the pipe at the valve locations.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Pipe, pipe fittings, and appurtenances shall be installed at the locations indicated. Excavation, trenching, and backfilling shall be as specified in Section 02316a EXCAVATION, TRENCHING AND BACKFILLING FOR UTILITIES SYSTEMS.

##### 3.1.1 Cutting

Pipe shall be cut in a neat manner with mechanical cutters. Wheel cutters shall be used where practicable. Sharp and rough edges shall be ground smooth and loose material removed from the pipe before laying.

##### 3.1.2 Laying

Except where otherwise authorized, pipe shall be laid with bells facing the direction of laying. Before lowering and while suspended, the pipe shall be inspected for defects. Defective material shall be rejected. Pipe shall be laid in compliance with the following:

- a. Polyethylene: ASTM D 2774.
- b. Polypropylene: ASTM D 2774.

##### 3.1.3 Jointing

###### 3.1.3.1 Joints for PE Pipe

Heat fusion joints shall comply with the manufacturer's instructions concerning equipment, temperature, melt time, heat coat, and joining time. Flanged and mechanical joints shall be made in compliance with the manufacturer's instructions.

###### 3.1.3.2 Joints for Polypropylene Pipe

Heat fusion joints shall comply with the manufacturer's instructions concerning equipment, temperature, melt time, heat coat, and joining time.

##### 3.1.4 Installation of Valves

Prior to installation, valves shall be cleaned of all foreign matter and inspected for damage. Valves shall be fully opened and closed to ensure that all parts are properly operating. Valves shall be installed with the stem in the vertical position.

### 3.1.5 Installation of Valve Boxes

Valve boxes shall be installed over each outside plug valve, unless otherwise indicated. Valve boxes shall be centered over the valve. Fill shall be carefully tamped around each valve box to a distance of 4 feet on all sides or to undisturbed trench face, if less than 4 feet.

### 3.1.6 Installation of Valve Vaults

Valve vaults shall be installed as indicated.

### 3.1.7 Thrust Restraint

Plugs, caps, tees and bends deflecting 11-1/4 degrees or more, either vertically or horizontally, shall be provided with thrust restraint. Valves shall be securely anchored or shall be provided with thrust restraints to prevent movement. Thrust restraints shall be either thrust blocks or, for ductile-iron pipes, restrained joints.

## 3.2 HYDROSTATIC TESTS

The pipeline shall be subjected to both a pressure test and a leakage test.

The method proposed for disposal of waste water from hydrostatic tests shall be approved by the Contracting Officer. Testing shall be the responsibility of the Contractor. Testing shall be performed by an approved independent testing laboratory or by the Contractor subject to approval. The test may be witnessed by the Contracting Officer. The Contracting Officer shall be notified at least 7 days in advance of equipment tests. The final test report shall be delivered to the Contracting Officer within 30 days of the test.

### 3.2.1 Pressure Test

After the pipe has been installed, joints completed have been in place for at least five days, and the trench has been partially backfilled, leaving the joints exposed for examination, the pipe shall be filled with water to expel all air. The pipeline shall be subjected to a test pressure of 50 psi or 150 percent of the working pressure, whichever is greater, for a period of at least one hour. Each valve shall be opened and closed several times during the test. The exposed pipe, joints, fitting, and valves shall be examined for leaks. Visible leaks shall be stopped or the defective pipe, fitting, joints, or valve shall be replaced.

### 3.2.2 Leakage Test

The leakage test may be conducted subsequent to or concurrently with the pressure test. The amount of water permitted as leakage for the line shall be placed in a sealed container attached to the supply side of the test pump. No other source of supply will be permitted to be applied to the pump or line under test. The water shall be pumped into the line by the test pump as required to maintain the specified test pressure as described for pressure test for a 2 hour period. Exhaustion of the supply or the inability to maintain the required pressure will be considered test

failure. PE pipe can experience diametric expansion and pressure elongation during initial testing. The manufacturer shall be consulted prior to testing for special testing considerations. Allowable leakage shall be determined by the following I-P formula:

$L = NDP/K$  Where:

L = Allowable leakage in gallons per hour.

N = Number of joints in length of pipeline tested.

D = Nominal diameter of the pipe in inches.

P = Square root of the test pressure in psig.

K = 7400 for pipe materials.

At the conclusion of the test, the amount of water remaining in the container shall be measured and the results recorded in the test report.

### 3.2.3 Retesting

If any deficiencies are revealed during any test, such deficiencies shall be corrected and the tests shall be reconducted until the results of the tests are within specified allowances, without additional cost to the Government.

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## SECTION 02560

## PAVEMENTS FOR SMALL PROJECTS

05/02

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## MONTANA DEPARTMENT OF TRANSPORTATION (MDOT)

MDOT Standard Specifications for Road and Bridge Construction, 1995 Edition

## ACI INTERNATIONAL (ACI)

ACI 211.1 (1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete

## AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO MP 1 (1998) Provisional Specification for Performance Graded Asphalt Binder

AASHTO T 180 (1997) Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and an 457 mm (18-in) Drop

AASHTO TP53 (1998; Interim 1999) Determining Asphalt Content of Hot Mix Asphalt by the Ignition Method

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 31/C 31M (2000e1) Making and Curing Concrete Test Specimens in the Field

ASTM C 39/C 39M (2001) Compressive Strength of Cylindrical Concrete Specimens

ASTM C 88 (1999a) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

ASTM C 136 (2001) Sieve Analysis of Fine and Coarse Aggregates

ASTM C 143/C 143M (2000) Slump of Hydraulic Cement Concrete

ASTM C 192/C 192M (2000) Making and Curing Concrete Test Specimens in the Laboratory

ASTM C 231	(1997e1) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 494/C 494M	(1999a) Chemical Admixtures for Concrete
ASTM C 509	(2000) Elastomeric Cellular Performed Gasket and Sealing Material
ASTM C 566	(1997) Total Evaporable Moisture Content of Aggregate by Drying
ASTM C 881	(1999) Epoxy-Resin-Base Bonding Systems for Concrete
ASTM D 789	(1998) Determination of Relative Viscosity and Moisture Content of Polyamide (PA)
ASTM D 946	(1982; R 1999) Penetration-Graded Asphalt Cement for Use in Pavement Construction
ASTM D 1461	(1985; R 2001) Moisture or Volatile Distillates in Bituminous Paving Mixtures
ASTM D 1557	(2000) Laboratory Compaction Characteristics of Soils Using Modified Effort (56,000 ft-lbf/ft (2,700 kN-m/m))
ASTM D 2041	(2000) Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
ASTM D 2172	(1995) Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
ASTM D 2726	(2000) Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixture
ASTM D 2950	(1991; R 1997) Density of Bituminous Concrete in Place by Nuclear Method
ASTM D 3381	(1992) Viscosity-Graded Asphalt Cement for Use in Pavement Construction
ASTM D 3666	(2001) Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
ASTM D 4125	(1994) Asphalt Content of Bituminous Mixtures by the Nuclear Method
ASTM D 4867/D 4867M	(1996) Effect of Moisture on Asphalt Concrete Paving Mixtures
ASTM D 5444	(1998) Mechanical Size Analysis of Extracted Aggregate
ASTM D 5893	(1996) Cold Applied, Single Component

Chemically Curing Silicon Joint Sealant  
for Portland Cement Concrete Pavement

ASTM D 6307

(1998) Asphalt Content of Hot Mix Asphalt  
by Ignition Method

CORPS OF ENGINEERS (COE) HAND BOOK FOR CONCRETE AND CEMENT

CRD-C 525

(1989) Corps of Engineers Test Method for  
Evaluation of Hot-Applied Joint Sealants  
for Bubbling Due to Heating

ASPHALT INSTITUTE (AI)

AI MS-2

(1994) Mix Design Methods for Asphalt  
Concrete and Other Hot-Mix Types

1.2 MEASUREMENT AND PAYMENT

Section "MEASUREMENTS AND PAYMENT" of the MDOT shall not apply.

1.3 MODIFICATION TO THE MDOT

Reference to "Engineer" and "Department" in the MDOT shall mean the  
Contracting Officer or Representative.

1.4 DEFINITIONS

For the purposes of this specification, the following definitions apply.

1.4.1 Degree of Compaction

Degree of compaction of aggregate base course, subbase course and aggregate  
surface course shall be expressed as a percentage of the maximum density  
obtained by the test procedure presented in either ASTM D 1557 or AASHTO T  
180, Method D. The maximum density shall be determined in accordance with  
ASTM D 1557 if the material gradation contains less than 30 percent  
retained on the 3/4 inch sieve or AASHTO T 180 if the material gradation  
contains more than 30 percent retained on the 3/4 inch sieve. In this  
specification, degree of compaction shall be a percentage of laboratory  
maximum density.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation;  
submittals not having a "G" designation are for information only. When  
used, a designation following the "G" designation identifies the office  
that will review the submittal for the Government. The following shall be  
submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Plant, Equipment, and Tools

Job Mix Formula; G-DO.

Proposed JMF.

Mixture Proportions; G-DO.

The report of the Contractor's mixture proportioning studies showing the proportions of all ingredients and supporting information on aggregate and other materials that will be used in the manufacture of concrete, at least 14 days prior to commencing concrete placing operations.

#### SD-06 Test Reports

##### Initial Tests; G-AO.

Certified copies of test results for approval not less than 20 days before material is required for the work.

##### Contractor Quality Control; G-AO.

The Contractor shall submit all QC test results to the Contracting Officer on a daily basis as the tests are performed.

##### Acceptability of Work; G-AO.

The Contractor shall submit all test results to the Contracting Officer on a daily basis as the tests are performed.

#### SD-07 Certificates

##### Asphalt Cement Binder; G-AO.

Copies of certified test data.

##### Bituminous Tack and Prime Coat; G-AO.

Copies of certified test data.

#### SD-08 Manufacturer's Instructions

##### Manufacturer's Recommendations; G-AO

Where installation procedures, or any part thereof, are required to be in accordance with the manufacturer's recommendations, printed copies of these recommendations, 20 days prior to use on the project. Installation of the material will not be allowed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

### 1.6 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by a testing laboratory approved in accordance with Section 01451 CONTRACTOR QUALITY CONTROL. Work requiring testing will not be permitted until the testing laboratory has been inspected and approved. The materials shall be tested to establish compliance with the specified requirements; testing shall be performed at the specified frequency. The Contracting Officer may specify the time and location of the tests.

### 1.7 APPROVAL OF MATERIAL

The source of the material for aggregate base course, subbase course, and aggregate surface course shall be selected 30 days prior to the time the

material will be required in the work. Tentative approval of material will be based on initial test results. Final approval of the materials will be based on sieve analysis, liquid limit, and plasticity index tests performed on samples taken from the completed and fully compacted base and subbase course.

## 1.8 WEATHER LIMITATIONS

### 1.8.1 Hot-Mix Asphalt Pavement

The hot-mix asphalt pavement shall not be placed upon a wet surface or when the surface temperature of the underlying course is less than specified in Table 1. The temperature requirements may be waived by the Contracting Officer, if requested; however, all other requirements, including compaction, shall be met.

Table 1. Surface Temperature Limitations of Underlying Course

Mat Thickness, inches	Degrees F
3 or greater	40
Less than 3	45

### 1.8.2 Bituminous Prime and Tack Coat

Bituminous coat shall be applied only when the surface to receive the bituminous coat is dry. Bituminous coat shall be applied only when the atmospheric temperature in the shade is 50 degrees F or above and when the temperature has not been below 35 degrees F for the 12 hours prior to application.

### 1.8.3 Portland Cement Concrete Pavement

#### 1.8.3.1 Hot Weather Paving

The temperature of concrete shall not exceed 90 degrees F. Steel forms, dowels and reinforcing shall be cooled prior to concrete placement when steel temperatures are greater than 120 degrees F.

#### 1.8.3.2 Cold Weather Paving

The ambient temperature of the air at the placing site and the temperature of surfaces to receive concrete shall be not less 40 degrees F. The temperature of the concrete when placed shall be not less than 50 degrees F. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Upon written approval, chemical admixture conforming to ASTM C 494/C 494M Type C or E may be used provided it contains no calcium chloride. Calcium chloride shall not be used at any time. Covering and other means shall be provided for maintaining the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period. Pavement damaged by freezing shall be completely removed and replaced at the Contractor's expense.

### 1.8.4 Base Course, Subbase Course, Aggregate Surface Course

Construction of aggregate base course, subbase course and aggregate surface course shall be done when the atmospheric temperature is above 35 degrees F.

When the temperature falls below 35 degrees F, the Contractor shall protect all completed areas by approved methods against detrimental effects of freezing. Completed areas damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements.

#### 1.9 PLANT, EQUIPMENT, AND TOOLS

All plant, equipment, and tools used in the performance of the work shall be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing pavements meeting the requirements as set forth herein.

### PART 2 PRODUCTS

#### 2.1 HOT-MIX ASPHALT PAVEMENT

Bituminous wearing course shall conform to the requirements specified in the MDOT, Section 401.02, "MATERIALS, Section 701.03.1, "General Requirements" and Section 701.03.2, "Aggregate for Plant Mix Surfacing", except as modified herein. The aggregate shall be Grade B conforming to Table 701-15. Coarse aggregate shall meet the following additional requirements: Percentage of loss shall not exceed 18 after 5 cycles when performed in accordance with ASTM C 88, using magnesium sulfate. The Contractor shall develop the mix design. The laboratory used to develop the job mix formula (JMF) shall meet the requirements of ASTM D 3666. A certification signed by the manager of the laboratory stating that it meets these requirements or clearly listing all deficiencies shall be submitted to the Contracting Officer prior to the start of construction. The asphalt mix shall be dense-graded and composed of a mixture of well-graded aggregate, mineral filler if required, and asphalt material. The hot-mix asphalt shall be designed using Marshall method of mix design contained in AI MS-2 and the criteria shown in Table 3. If the Tensile Strength Ratio (TSR) of the composite mixture, as determined by ASTM D 4867/D 4867M is less than 75, the aggregates shall be rejected or the asphalt mixture treated with an approved anti-stripping agent. The amount of anti-stripping agent added shall be sufficient to produce a TSR of not less than 75. If an antistrip agent is required, it shall be provided by the Contractor at no additional cost. The hot-mix asphalt pavement shall not contain more than 15 percent reclaimed asphalt pavement.

##### 2.1.1 JMF Requirements

The job mix formula shall be submitted in writing by the Contractor for approval at least 14 days prior to the start of the test section and shall include as a minimum:

- a. Percent passing each sieve size.
- b. Percent of asphalt cement.
- c. Percent of each aggregate and mineral filler to be used.
- d. Asphalt viscosity grade or performance grade.
- e. Number of blows of hammer per side of molded specimen.

- f. Laboratory mixing temperature.
- g. Lab compaction temperature.
- h. Temperature-viscosity relationship of the asphalt cement.
- i. Plot of the combined gradation on the 0.45 power gradation chart, stating the nominal maximum size.
- j. Graphical plots of stability, flow, air voids, voids in the mineral aggregate, and unit weight versus asphalt content as shown in AI MS-2.
- k. Specific gravity and absorption of each aggregate.
- l. Percent natural sand.
- m. Percent particles with 2 or more fractured faces (in coarse aggregate).
- n. Fine aggregate angularity.
- o. Percent flat or elongated particles (in coarse aggregate).
- p. Tensile Strength Ratio(TSR).
- q. Antistrip agent (if required) and amount.
- r. List of all modifiers and amount.
- s. Percentage and properties (asphalt content, binder properties, and aggregate properties) of reclaimed asphalt pavement (RAP) if RAP is used.

Table 2. Marshall Design Criteria

<u>Test Property</u>	<u>50 Blow Mix</u>
Stability, pounds minimum	*1000
Flow, 0.01 inch	8-18
Air voids, percent	3-5
Percent Voids in mineral aggregate VMA, (minimum) Grade B	14.0
TSR, minimum percent	75

\* This is a minimum requirement. The average during construction shall be significantly higher than this number to ensure compliance with the specifications.

\*\* Calculate VMA in accordance with AI MS-2, based on ASTM D 2726 bulk specific gravity for the aggregate.

### 2.1.2 Adjustments to Field JMF

The Laboratory JMF for each mixture shall be in effect until a new formula is approved in writing by the Contracting Officer. Should a change in sources of any materials be made, a new laboratory JMF design shall be performed and a new JMF approved before the new material is used.

### 2.1.3 Asphalt Cement Binder

Asphalt cement binder shall conform to ASTM D 3381, Table 2, Viscosity Grade AC-5, AASHTO MP 1 Performance Grade (PG) 58-34 or ASTM D 946 penetration grade 120-150. Test data indicating grade certification shall be provided by the supplier at the time of delivery of each load to the mix plant. Copies of these certifications shall be submitted to the Contracting Officer. The supplier is defined as the last source of any modification to the binder.

## 2.2 BITUMINOUS TACK AND PRIME COAT

Test data indicating grade certification shall be provided by the supplier. Copies of these certifications shall be submitted to the Contracting Officer.

### 2.2.1 Bituminous Prime Coat

Bituminous prime coat shall conform to the requirements specified in Section 702, "BITUMINOUS MATERIALS", of the MDOT. Bituminous materials shall be liquid asphalt, designation MC-30, or MC-70 at the Contractor's option, except that only MC-30 shall be used on dense graded base courses if MC-70 does not adequately penetrate the base course material. In lieu of cut-back asphalt, the Contractor may use cationic emulsified asphalt, designation CSS-1 or CSS-1h.

### 2.2.2 Bituminous Tack Coat

Bituminous tack coat shall conform to the requirements specified in Section 702, "BITUMINOUS MATERIALS" of the MDOT. Bituminous material shall be emulsified asphalt designation SS-1 or SS-1h, or cationic emulsified asphalt designation CSS-1 or CSS-1h.

## 2.3 PORTLAND CEMENT CONCRETE PAVEMENT

### 2.3.1 Portland Cement Concrete

Portland cement concrete shall conform to the requirements specified in Section 501.02.1, "Concrete", and Section 551 "PORTLAND CEMENT CONCRETE" of the MDOT except as otherwise specified herein. Proportioning of the mix shall conform to the requirements of Class "AP" or "DP" concrete. The required minimum 28-day field compressive strength of Class "AP" or "DP" concrete shall be 3400 psi. No flexural strength tests will be required. The coarse aggregate shall have a maximum nominal size of 1-1/2 inches. The maximum allowable slump of the concrete shall be 3 inches for pavement constructed with fixed forms. For slipformed pavement, the maximum allowable slump shall be 1-1/4 inches. The water-cement ratio shall not exceed 0.45. The air content of the concrete by volume shall be maintained by the Contractor at 5 to 7 percent. The Contractor shall submit design mixture proportions, laboratory trial mix, aggregate data, and 28-day compressive strength test results. Trial design batches, mixture proportioning studies, and testing shall be the responsibility of the

Contractor, and shall be performed by the Test Laboratory and signed by a Registered Engineer. No concrete pavement shall be placed until the Contracting Officer has approved the Contractor's mixture proportions. All materials used in mixture proportioning studies shall be representative of those proposed for use on the project. If there is a change in materials, additional mixture design studies shall be made using the new materials. Trial mixtures having proportions, slumps, and air content suitable for the work shall be based on methodology described in ACI 211.1.

#### 2.3.2 Welded Steel Wire Fabric

Welded steel wire fabric shall conform to Section 711.01.3 "Wire and Wire Mesh" of the MDOT.

#### 2.3.3 Dowels Bars and Tie Bars

Dowel bars shall conform to Section 501.02.3 "Dowel Bars and Sleeves" of the MDOT. Tie bars shall conform to Section 501.02.4 "Tie Bars" of the MDOT.

#### 2.3.4 Epoxy Resin

Epoxy resin materials for embedding dowels shall be two-component materials conforming to the requirements of ASTM C 881, Type IV, Grade 3. Class shall be appropriate for each application temperature to be encountered.

#### 2.4 CURING COMPOUND

Curing compound for portland cement concrete pavement shall conform to Section 501.02.6 "Curing Compound" of the MDOT.

#### 2.5 JOINT FILLER, BACKER ROD AND SEALANT

Preformed expansion joint filler shall conform to Section 707.01.1.A, "Expansion Joint Filler" of the MDOT. The backer rod shall be a compressible, nonshrinking, nonstaining, nonabsorbing material and shall be nonreactive with the joint sealant. The material shall have a melting point at least 5 degrees F greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D 789. The material shall have a water absorption of not more than 5 percent of the sample weight when tested in accordance with ASTM C 509. The backer rod shall be 25 plus or minus 5 percent larger in diameter than the nominal width of the crack. Joint sealant shall be either hot or cold-applied. Cold-applied silicone joint sealant shall conform to ASTM D 5893. Hot-applied joint sealant shall conform to Section 707.01.1.B, "Joint Sealing Material" of the MDOT and CRD-C 525.

#### 2.6 AGGREGATE BASE COURSE (ABC)

Aggregate base course aggregate shall conform to the requirements specified in Section 301, "AGGREGATE SURFACING", Section 701.02 "AGGREGATE FOR SURFACING" and Section 701.02.4 "Crushed Base Course Type A" of the MDOT, except as modified herein. Aggregate base course shall be MDOT Type A, Class 5 or 6, except as otherwise specified herein. The portion retained on the No. 4 sieve shall be known as coarse aggregate; that portion passing the No. 4 sieve shall be known as fine aggregate. Aggregates shall be angular particles of uniform density. Coarse aggregate shall be crushed gravel, crushed stone, crushed recycled concrete, or crushed slag. Fine aggregate shall consist of screenings, angular sand, crushed recycled concrete fines, or other finely divided mineral matter processed or

naturally combined with the coarse aggregate. The amount of flat and elongated particles shall not exceed 30 percent. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. In the portion retained on each sieve specified, the crushed aggregates shall contain at least 50 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the piece. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces. Crushed gravel shall be manufactured from gravel particles 50 percent of which, by weight, are retained on the maximum size sieve. The percentage of loss shall not exceed 18 after 5 cycles when performed in accordance with ASTM C 88, using magnesium sulfate. When tested for gradation, the percentage passing the No. 200 sieve shall not exceed 10 percent and the No. 635 sieve shall not exceed 3.0 percent.

## 2.7 SUBBASE COURSE

Subbase course aggregate shall conform to the requirements specified in Section 301, "AGGREGATE SURFACING", Section 701.02 "AGGREGATE FOR SURFACING" and Section 701.02.4 "Crushed Base Course Type A" of the MDOT, except as modified herein. Subbase courses shall be MDOT Class 5 or 6 except as otherwise specified herein. The aggregate shall meet the following additional properties; the aggregate shall be a crushed quarry rock, gravel, crushed gravel, crushed screenings, sand or a combination thereof. The No. 635 sieve shall not exceed 6.0 percent.

## 2.8 AGGREGATE SURFACE COURSE

Crushed aggregate surface course shall conform to the requirements specified in Section 301, "AGGREGATE SURFACING", Section 701.02 "AGGREGATE FOR SURFACING" and Section 701.02.6 "Crushed Top Surface Type A", of the MDOT, except as modified herein. Aggregate surface course shall be MDOT Class 1, 2, 3 or 4 except as otherwise specified herein. The amount of flat and elongated particles shall not exceed 20 percent. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. The aggregate for the surface course shall contain a minimum 80 percent crushed material.

## 2.9 INITIAL TESTS

One of each of the following tests shall be performed on the proposed aggregate base course, subbase course and aggregate surface course material prior to commencing construction to demonstrate that the proposed material meets all specified requirements when furnished. If materials from more than one source are going to be utilized, this testing shall be completed for each source.

- a. Sieve Analysis including No. 635 size material.
- b. Liquid limit and plasticity index.
- c. Moisture-density relationship.
- d. Wear.
- e. Soundness.

### PART 3 EXECUTION

#### 3.1 PAVEMENT REMOVAL

Where bituminous pavement is to be removed, the pavement shall be sawed with a pre-approved concrete saw so as to leave a straight true edge. Pavement material from the removal area shall be disposed of outside the limits of Government controlled land at the Contractor's expense.

#### 3.2 HOT-MIX ASPHALT PAVEMENT

Hot-mix asphalt pavement wearing course shall be constructed to the requirements specified in the MDOT, Section 401, "PLANT MIX PAVEMENT, except as modified herein.

##### 3.2.1 Contractor Quality Control

A standard lot for all requirements will be equal to 8 hours of production.

##### 3.2.1.1 Asphalt Content

A minimum of two tests to determine asphalt content will be performed per lot by one of the following methods: the extraction method in accordance with ASTM D 2172, Method A or B, the ignition method in accordance with the AASHTO TP53 or ASTM D 6307, or the nuclear method in accordance with ASTM D 4125, provided the nuclear gauge is calibrated for the specific mix being used. For the extraction method, the weight of ash, as described in ASTM D 2172, shall be determined as part of the first extraction test performed at the beginning of plant production; and as part of every tenth extraction test performed thereafter, for the duration of plant production. The last weight of ash value obtained shall be used in the calculation of the asphalt content for the mixture.

##### 3.2.1.2 Gradation

Aggregate gradations shall be determined a minimum of twice per lot from mechanical analysis of recovered aggregate in accordance with ASTM D 5444. When asphalt content is determined by the nuclear method, aggregate gradation shall be determined from hot bin samples on batch plants, or from the cold feed on drum mix plants. For batch plants, aggregates shall be tested in accordance with ASTM C 136 using actual batch weights to determine the combined aggregate gradation of the mixture.

##### 3.2.1.3 Temperatures

Temperatures shall be checked at least four times per lot, at necessary locations, to determine the temperature at the dryer, the asphalt cement in the storage tank, the asphalt mixture at the plant, and the asphalt mixture at the job site.

##### 3.2.1.4 Aggregate Moisture

The moisture content of aggregate used for production shall be determined a minimum of once per lot in accordance with ASTM C 566.

##### 3.2.1.5 Moisture Content of Mixture

The moisture content of the mixture shall be determined at least once per

lot in accordance with ASTM D 1461 or an approved alternate procedure.

#### 3.2.1.6 Laboratory Air Voids, Marshall Stability and Flow

Mixture samples shall be taken at least four times per lot and compacted into specimens, using 50 blows per side with the Marshall hammer. After compaction, the laboratory air voids of each specimen shall be determined, as well as the Marshall stability and flow.

#### 3.2.2 Acceptability of Work

The pavement will be accepted on the basis of tests made by the the Contractor or its suppliers, as specified herein. The Government may, at its discretion, make check tests to validate the results of the Contractor's testing.

##### 3.2.2.1 Sampling Pavements

Samples of the finished pavement, shall be obtained by the Contractor. The location of the samples shall be as directed and the cores shall be at least 4 inches in diameter. The samples shall be tested by the Contractor to determine conformance to density. Specimens shall be tested in accordance with the requirements of ASTM D 2726. Three samples shall be taken and tested for each 750 tons or less of bituminous mixture placed each day. A minimum of one core shall be obtained from the longitudinal joint. The Contractor shall fill all cores holes with new material and shall meet the requirements as described herein.

##### 3.2.2.2 Laboratory Air Voids

Laboratory air voids will be calculated by determining the Marshall density of each laboratory compacted specimen using ASTM D 2726 and determining the theoretical maximum density of every other subplot sample using ASTM D 2041.

Laboratory air void calculations for each subplot will use the latest theoretical maximum density values obtained, either for that subplot or the previous subplot. The mean absolute deviation of the four laboratory air void contents (one from each subplot) from the JMF air void content will be evaluated. The mean absolute deviation shall be less than 1.00. All laboratory air void tests will be completed and reported within 24 hours after completion of construction of each lot.

##### 3.2.2.3 In-place Density

Density of the compacted mixture of the bituminous wearing course shall be between 97 and 100 percent (joint density 95 to 100 percent) of the maximum laboratory compacted density. The maximum laboratory compacted specimens shall be determined from the same mixture taken from the plant in accordance with ASTM D 2041. Densities of the in-place compacted mixture may be determined by the nuclear method in accordance with ASTM D 2950 for Contractor quality control purposes. In any event, the basis of acceptance for density shall be determined from the specific gravity method.

##### 3.2.2.4 Surface Smoothness

After the final rolling, but not later than 24 hours after placement, the surface of the pavement in each entire lot shall be tested by the Contractor in such a manner as to reveal all surface irregularities exceeding the tolerances specified below. If any pavement areas are ground, these areas shall be retested immediately after grinding. All

testing shall be performed in the presence of the Contracting Officer. Detailed notes of the results of the testing shall be kept and a copy furnished to the Government immediately after each day's testing. The entire area of the pavement shall be tested in both a longitudinal and a transverse direction on parallel lines. The transverse lines shall be 25 feet or less apart, as directed. The longitudinal lines shall be at the centerline of each paving lane for lines less than 20 feet and at the third points for lanes 20 feet or greater. Other areas having obvious deviations shall also be tested. Longitudinal testing lines shall be continuous across all joints. Where drawings show required deviations from a plane surface (crowns, drainage inlets, etc.), the surface shall be finished to meet the approval of the Contracting Officer. The straightedge shall be held in contact with the surface and moved ahead one-half the length of the straightedge for each successive measurement. The amount of surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between these two high points. The finished surfaces of the pavements shall have no abrupt change of 3/16 inch or more, and all pavements shall be within the tolerances specified in Table 3 when checked with an approved 10 foot straightedge.

Table 3. Straightedge Surface Smoothness--Pavements

<u>Pavement Category</u>	<u>Direction of Testing</u>	<u>Tolerance, inches</u>
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All	Longitudinal	3/16
paved areas	Transverse	3/16

3.3 BITUMINOUS TACK AND PRIME COAT

Except as otherwise specified herein, application of bituminous tack and prime coat shall be in accordance with Section 407, BITUMINOUS PRIME AND TACK COAT" of the MDOT. Following application of the bituminous material and prior to the application of the pavement, the bituminous coat shall be allowed to cure and to obtain evaporation of any volatiles or moisture.

3.3.1 Bituminous Tack Coat

Contact surfaces of previously constructed pavement, curbs, manholes, and other structures shall be sprayed with a thin coat of bituminous tack coat. Rate of application shall be not less than 0.05 gallon nor more than 0.15 gallon per square yard.

3.3.2 Bituminous Prime Coat

A prime coat will be required if it will be at least seven days before a the surfacing (Asphalt cement hot mix concrete)layer is constructed on the underlying (base course, etc) compacted material. The type of liquid asphalt and application rate will be as specified herein. The Contractor shall protect the underlying from any damage (water, traffic, etc.) until the surfacing is placed. If the Contractor places the surfacing within seven days, the choice of protection measures or actions to be taken is at the Contractor's option. Damage to the underlying material caused by lack of, or inadequate, protection shall be repaired (recompacted or replaced) by approved methods at no additional cost to the Government. If the Contractor options to use the prime coat, it shall be applied as soon as

possible after consolidation of the underlying material. Rate of application shall be not less than 0.15 gallon nor more than 0.40 gallon per square yard. To obtain uniform application of the prime coat on the surface treated at the junction of previous and subsequent applications, building paper shall be spread on the surface for a sufficient distance back from the ends of each application to start and stop the prime coat on the paper. Immediately after application, the building paper shall be removed and destroyed. Prime coat shall be allowed to cure without being disturbed for a period of at least 48 hours or longer, as may be necessary to attain penetration into the treated course.

### 3.4 PORTLAND CEMENT CONCRETE PAVEMENT

Except as otherwise specified herein, portland cement concrete shall be constructed in accordance with the requirements specified in Section 501, "PORTLAND CEMENT CONCRETE PAVEMENT" and Section 551, "PORTLAND CEMENT CONCRETE" of the MDOT. Grooving and tining of concrete is not required.

#### 3.4.1 Spreading

Spreading shall be by machine or hand method. Hand spreading will be permitted only when approved for odd widths or shapes of slabs, or for placement of separate, isolated slabs during removal and replacement type repair operations, or for lanes 50 feet or less in length. Hand spreading, where permitted, shall be done with shovels; rakes shall not be used. Where the concrete is delivered to the form in truck mixers, suitable chutes may be used, provided windrows cover essentially the entire area within the form. In no case shall dumping of concrete in piles be permitted.

#### 3.4.2 Placing Reinforcing Steel

Reinforcement shall be positioned on suitable chairs securely fastened to the subgrade prior to concrete placement, or may be placed on an initial layer of consolidated concrete, with the subsequent layer placed within 30 minutes of the first layer placement.

#### 3.4.3 Joints

Transverse and longitudinal contraction joints shall be of the weakened plane type and shall be formed by sawing. Joints shall be sealed with hot-applied or cold-applied sealant immediately following curing of the concrete or as soon thereafter as weather conditions permit. Before sealing operations commence, a copy of the Manufacturer's Recommendations pertaining to the storage, heating and application of the sealant shall be submitted to the Contracting Officer.

#### 3.4.4 Contractor Quality Control

The Contractor shall perform the inspection and tests described below at the placement and, based upon the results of these inspections and tests, shall take the action required and submit reports as specified. When, in the opinion of the Contracting Officer, the paving operation is out of control, concrete placement shall cease. The Contractor shall furnish all materials, labor, and facilities required for molding, curing, testing, and protecting test specimens at the site and in the laboratory.

##### 3.4.4.1 Air Content Testing

Air content tests shall be made when test specimens are fabricated. In addition, at least two other tests for air content shall be made on randomly selected batches of each separate concrete mixture produced during each 8-hour period of paving. All air content measurements shall be determined in accordance with ASTM C 231. Whenever air content reaches specified limits, an immediate confirmatory test shall be made. If the second test also shows air content at or exceeding specified limits, an adjustment shall immediately be made in the amount of air-entraining admixture batched to bring air content within specified limits. If the next adjusted batch of concrete is not within specified limits, concrete placement shall be halted until concrete air content is within specified limits.

#### 3.4.4.2 Slump Testing

Slump tests shall be made when test specimens are fabricated. Additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. All slump tests shall be made in accordance with ASTM C 143/C 143M. Whenever slump approaches the maximum limit, an adjustment shall immediately be made in the batch masses of water and fine aggregate. When a slump result exceeds the specification limit, no further concrete shall be delivered to the paving site until adjustments have been made and slump is again within the limit.

#### 3.4.4.3 Temperature

The temperature of the concrete shall be measured when strength specimens are fabricated.

#### 3.4.4.4 Concrete Strength Testing

Four (4) cylinders from the same batch shall be fabricated, cured and tested for compressive strength, testing two cylinders at 7-day and two cylinders at 28-day age. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days. A minimum of one set of four (4) cylinders shall be fabricated, cured and tested for each shift of concrete placement nor less than once for each 250 cubic yards of concrete or fraction thereof. All test cylinders shall be 6 by 12 inch cylinders and shall be fabricated in accordance with ASTM C 192/C 192M, using only steel molds, cured in accordance with ASTM C 31/C 31M, and tested in accordance with ASTM C 39/C 39M. Control charts for strength, showing the 7-day and 28-day CQC compressive strengths, and the 28-day required compressive strength, shall be maintained and submitted with weekly CQC Reports.

#### 3.4.5 Acceptability of Work

The pavement will be accepted on the basis of tests made by the Contractor or its suppliers, as specified herein. The Government may, at its discretion, make check tests to validate the results of the Contractor's testing.

##### 3.4.5.1 Strength Requirements

A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days. The strength of the concrete will be considered satisfactory so long as the running average of all sets of three consecutive test results equals or exceeds the specified 28-day field compressive strength and no individual test result

falls below the specified strength by more than 500 psi. The Contractor shall furnish all materials, labor, and facilities required for molding, curing, testing, and protecting test specimens at the site and in the laboratory.

#### 3.4.5.2 Surface Smoothness Requirements

The surface of the pavement shall be tested with a 10 foot straightedge to identify all surface irregularities exceeding the tolerances specified above. The entire area of the pavement shall be tested in both a longitudinal and a transverse direction on parallel lines approximately 15 feet apart. The straightedge shall be held in contact with the surface and moved ahead one-half the length of the straightedge for each successive measurement. The amount of surface irregularity shall be determined by placing the straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length and measuring the maximum gap between the straightedge and the pavement surface, in the area between these two high points. The finished surfaces of the pavements shall have no abrupt change of 1/8 inch or more. All pavements shall have a surface smoothness tolerance within 1/4 inch in the transverse and longitudinal direction, except that roads and streets shall have tolerance of 3/16 inch in the longitudinal direction. In areas not meeting the specified limits for surface smoothness, high areas shall be reduced to attain the required smoothness, except as depth is limited below. High areas shall be reduced by grinding the hardened concrete with a surface grinding machine after the concrete is 14 days or more old. The depth of grinding shall not exceed 1/4 inch. All pavement areas requiring surface smoothness corrections in excess of the specified limits, shall be removed and replaced. All areas in which grinding has been performed will be subject to the thickness tolerances specified in paragraph Thickness. Any grinding performed on individual slabs with excessive deficiencies shall be performed at the Contractor's own decision without entitlement to additional compensation if eventual removal of the slab is required.

#### 3.4.5.3 Thickness Determination

The thickness of the pavement shall be determined by the Government on the basis of measurements made on 4 inch diameter cores which shall be drilled by the Contractor, within 7 days after placement of the concrete. Cores shall be drilled at the points directed by the Contracting Officer and there shall be at least one core taken from each separate pavement areas of 4000 sq yd or less. The Contractor shall fill the core holes with an approved non-shrink high strength grout. For pavements less than 8 inches in thickness, when any core shows a deficiency in thickness greater than 1/4 inch, the pavement area represented by the core shall be removed and replaced by the Contractor at no cost to the Government.

### 3.5 AGGREGATE COURSES

Aggregate base course, subbase course, and aggregate surface course shall be constructed in accordance with the requirements specified in Section 301, "AGGREGATE SURFACING" of the MDOT, except as modified herein. The aggregate base course, subbase course and aggregate surface course shall be compacted to 100 percent of laboratory maximum density.

#### 3.5.1 Placing

The mixed material shall be placed on the prepared subgrade or subbase in layers of uniform thickness with an approved spreader. When a compacted

layer 6 inches or less in thickness is required, the material shall be placed in a single layer. When a compacted layer in excess of 6 inches is required, the material shall be placed in layers of equal thickness. No layer shall exceed 6 inches or less than 3 inches when compacted.

### 3.5.2 Acceptability of Work

The aggregate base course, subbase course, and aggregate surface course will be accepted on the basis of tests made by the Contractor as specified herein. The Government may, at its discretion, make check tests to validate the results of the Contractor's testing.

#### 3.5.2.1 In-Place Tests

One of each of the following tests shall be performed on samples taken from the placed and compacted aggregate course. Samples shall be taken and tested at the rates indicated for each layer of material placed.

a. Density tests shall be performed on every lift of material placed and at a frequency of one set of tests for every 250 square yards, or portion thereof, of completed area.

b. Sieve Analysis including No. 635 size material shall be performed on every lift of material placed and at a frequency of one test for every 1000 square meters, or portion thereof, of completed area for every 500 tons, or portion thereof, of material placed.

c. Liquid limit and plasticity index tests shall be performed at the same frequency as the sieve analysis.

#### 3.5.2.2 Thickness

The total compacted thickness of the aggregate course shall be within 1/2 inch of the thickness indicated. Where the measured thickness is more than 1/2 inch deficient, such areas shall be corrected by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 1/2 inch thicker than indicated, the course shall be considered as conforming to the specified thickness requirements. Average job thickness shall be the average of all thickness measurements taken for the job, but shall be within 1/4 inch of the thickness indicated. The total thickness of the aggregate course shall be measured at intervals in such a manner as to ensure one measurement for each 500 square yards of aggregate course. Measurements shall be made in 3 inch diameter test holes penetrating the aggregate course.

#### 3.5.2.3 Smoothness

The surface of the top layer shall show no deviations in excess of 3/8 inch when tested with a 10 foot straightedge applied parallel with and at right angles to the centerline of the area to be paved. Measurements shall be taken in successive positions parallel to the centerline of the area to be paved. Measurements shall also be taken perpendicular to the centerline at 50 foot intervals. Deviations exceeding this amount shall be corrected by removing material and replacing with new material, or by reworking existing material and compacting it to meet these specifications.

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STORM-DRAINAGE SYSTEM  
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## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO HB-16	(1996) Standard Specifications for Highway Bridges
AASHTO M 198	(1998) Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets
AASHTO M 294	(2002) Corrugated Polyethylene Pipe, 300- to 1200- mm Diameter
AASHTO MP 7	(2001) Corrugated Polyethylene Pipe, 1350 and 1500 mm Diameter

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 48	(1994a) Gray Iron Castings
ASTM A 536	(1999e1) Ductile Iron Castings
ASTM A 762/A 762M	(1998) Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains
ASTM A 798/A 798M	(1997a) Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications
ASTM A 929/A 929M	(1997) Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe
ASTM C 76	(1999) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 231	(1997e1) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 270	(1997) Mortar for Unit Masonry
ASTM C 443	(1998) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets

ASTM D 1056	(1998) Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1171	(1994) Rubber Deterioration - Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens)
ASTM D 1557	(1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 1784	(1999a) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2321	(1989; R 1995) Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 2922	(1996el) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1996el) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 3034	(1998) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3350	(1998a) Polyethylene Plastics Pipe and Fittings Materials
ASTM F 477	(1999) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 679	(1995) Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
ASTM F 794	(1999) Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
ASTM F 894	(1998a) Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
ASTM F 949	(1999) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### SD-03 Product Data

##### Placing Pipe;

Printed copies of the manufacturer's recommendations for installation procedures of the material being placed, prior to installation.

#### SD-07 Certificates

##### Resin Certification;

Determination of Density; G-AO  
Frame and Cover for Gratings;

Certified copies of test reports demonstrating conformance to applicable pipe specifications, before pipe is installed. Certification on the ability of frame and cover or gratings to carry the imposed live load.

### 1.3 DELIVERY, STORAGE, AND HANDLING

#### 1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install plastic pipe shall be stored in accordance with the manufacturer's recommendations and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

#### 1.3.2 Handling

Materials shall be handled in a manner that ensures delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

## PART 2 PRODUCTS

### 2.1 PIPE FOR CULVERTS AND STORM DRAINS

Pipe for culverts and storm drains shall be of the sizes indicated and

shall conform to the requirements specified.

#### 2.1.1 Concrete Pipe

ASTM C 76, Class as indicated.

#### 2.1.2 Polymer Precoated Corrugated Steel Pipe

ASTM A 762/A 762M, corrugated steel pipe fabricated from ASTM A 742/A 742M Grade 10/10 polymer precoated sheet of either:

- a. Type I or II pipe (as indicated) with helical 2-2/3 by 1/2 inch corrugations.
- b. Type IR or IIR pipe (as indicated) with helical 3/4 by 3/4 by 7-1/2 inch corrugations.

#### 2.1.3 PVC Pipe

The pipe manufacturer's resin certification, indicating the cell classification of PVC used to manufacture the pipe, shall be submitted prior to installation of the pipe.

##### 2.1.3.1 Type PSM PVC Pipe

ASTM D 3034, Type PSM, maximum SDR 35, produced from PVC certified by the compounder as meeting the requirements of ASTM D 1784, minimum cell class 12454-B.

##### 2.1.3.2 Profile PVC Pipe

ASTM F 794, Series 46, produced from PVC certified by the compounder as meeting the requirements of ASTM D 1784, minimum cell class 12454-B.

##### 2.1.3.3 Smooth Wall PVC Pipe

ASTM F 679 produced from PVC certified by the compounder as meeting the requirements of ASTM D 1784, minimum cell class 12454-B.

##### 2.1.3.4 Corrugated PVC Pipe

ASTM F 949 produced from PVC certified by the compounder as meeting the requirements of ASTM D 1784, minimum cell class 12454-B.

#### 2.1.4 PE Pipe

The pipe manufacturer's resin certification indicating the cell classification of PE used to manufacture the pipe shall be submitted prior to installation of the pipe. The minimum cell classification for polyethylene plastic shall apply to each of the seven primary properties of the cell classification limits in accordance with ASTM D 3350.

##### 2.1.4.1 Corrugated PE Pipe

AASHTO M 294, Type S or D, for pipes 12 to 48 inches and AASHTO MP 7, Type S or D, for pipes 54 to 60 inches produced from PE certified by the resin producer as meeting the requirements of ASTM D 3350, minimum cell class in accordance with AASHTO M 294. Pipe walls shall have the following properties:

Nominal Size (in.)	Minimum Wall Area (square in/ft)	Minimum Moment of Inertia of Wall Section (in to the 4th/in)
12	1.50	0.024
15	1.91	0.053
18	2.34	0.062
24	3.14	0.116
30	3.92	0.163
36	4.50	0.222
42	4.69	0.543
48	5.15	0.543

2.1.4.2 Profile Wall PE Pipe

ASTM F 894, RSC 160, produced from PE certified by the resin producer as meeting the requirements of ASTM D 3350, minimum cell class 334433C. Pipe walls shall have the following properties:

Nominal Size (in.)	Minimum Wall Area (square in/ft)	Minimum Moment Of Inertia of Wall Section (in to the 4th/in)	
		Cell Class 334433C	Cell Class 335434C
18	2.96	0.052	0.038
21	4.15	0.070	0.051
24	4.66	0.081	0.059
27	5.91	0.125	0.091
30	5.91	0.125	0.091
33	6.99	0.161	0.132
36	8.08	0.202	0.165
42	7.81	0.277	0.227
48	8.82	0.338	0.277

2.2 DRAINAGE STRUCTURES

2.2.1 Flared End Sections

Sections shall be of a standard design fabricated from zinc coated steel sheets meeting requirements of ASTM A 929/A 929M or reinforced concrete.

2.3 MISCELLANEOUS MATERIALS

2.3.1 Concrete

Unless otherwise specified, reinforced concrete shall conform to the requirements for 3000 psi concrete under Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. The concrete mixture shall have air content by volume

of concrete, based on measurements made immediately after discharge from the mixer, of 5 to 7 percent when maximum size of coarse aggregate exceeds 1-1/2 inches. Air content shall be determined in accordance with ASTM C 231.

The concrete covering over steel reinforcing shall not be less than 1-1/2 inches thick for walls and flooring. Concrete covering deposited directly against the ground shall have a thickness of at least 3 inches between steel and ground.

### 2.3.2 Mortar

Mortar for pipe connections to drainage structures shall conform to ASTM C 270, Type M, except that the maximum placement time shall be 1 hour. The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar but in no case shall exceed 5 gallons of water per sack of cement. Water shall be clean and free of harmful acids, alkalies, and organic impurities. The mortar shall be used within 30 minutes after the ingredients are mixed with water. The inside of the joint shall be wiped clean and finished smooth. The mortar head on the outside shall be protected from air and sun with a proper covering until satisfactorily cured.

### 2.3.3 Frame and Cover for Gratings

Frame and cover for gratings shall be cast gray iron, ASTM A 48, Class 35B or cast ductile iron, ASTM A 536, Grade 65-45-12. Weight, shape, size, and waterway openings for grates shall be as indicated on the plans.

### 2.3.4 Joints

#### 2.3.4.1 Flexible Watertight Joints for Concrete Pipe

a. Materials: Flexible watertight joints shall be made with plastic or rubber-type gaskets for concrete pipe. The design of joints and the physical requirements for plastic gaskets shall conform to AASHTO M 198, and rubber-type gaskets shall conform to ASTM C 443. Gaskets shall have not more than one factory-fabricated splice.

#### 2.3.4.2 Flexible Watertight, Gasketed Joints for CMP

a. Gaskets: Corrugated metal pipe couplings shall have gaskets. The closed-cell expanded rubber gaskets for annular bands shall be a continuous band approximately 7 inches wide and approximately 3/8 inch thick, meeting the requirements of ASTM D 1056, Type 2, Class A1 or B3, and shall have a quality retention rating of not less than 70 percent when tested for weather resistance by ozone chamber exposure, Method B of ASTM D 1171. Rubber O-ring gaskets for semi-corrugated bands shall be 13/16 inch in diameter for pipe diameters of 36 inches or smaller and 7/8 inch in diameter for larger pipe having 1/2 inch deep end corrugation. O-rings shall meet the requirements of AASHTO M 198 or ASTM C 443. Flexible plastic gaskets shall conform to requirements of AASHTO M 198, Type B.

b. Connecting Bands: Connecting bands shall be either annular or semi-corrugated (hugger) type as indicated. Annular band shall have either rod and lug or angle-bolt type connector. Semi-corrugated bands shall have rod and lug type connector.

#### 2.3.4.3 PVC Plastic Pipes

Joints shall be solvent cement or elastomeric gasket type in accordance with the specification for the pipe and as recommended by the pipe manufacturer.

#### 2.3.4.4 Corrugated PE Plastic Pipe

Water tight joints shall be made using a PVC or PE coupling and rubber gaskets as recommended by the pipe manufacturer. Split-type bands shall not be allowed. Rubber gaskets shall conform to ASTM F 477. Soil tight joints shall conform to the requirements in AASHTO HB-16, Division II, Section 26.4.2.4. (e) for soil tightness and shall be as recommended by the pipe manufacturer.

#### 2.3.4.5 Profile Wall PE Plastic Pipe

Joints shall be gasketed or thermal weld type with integral bell in accordance with ASTM F 894.

### 2.4 DOWNSPOUT BOOTS

Boots used to connect exterior downspouts to the storm-drainage system shall be of gray cast iron conforming to ASTM A 48, Class 30B or 35B. Shape and size shall be as indicated. Boots shall be painted to match color of downspouts.

## PART 3 EXECUTION

### 3.1 EXCAVATION FOR PIPE CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES

Excavation of trenches, and for appurtenances and backfilling for culverts and storm drains, shall be in accordance with the applicable portions of Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS and the requirements specified below.

#### 3.1.1 Trenching

The width of trenches at any point below the top of the pipe shall be not greater than required to permit satisfactory jointing and thorough tamping of the bedding material under and around the pipe. Sheeting and bracing, where required, shall be placed within the trench width as specified. Contractor shall not overexcavate.

#### 3.1.2 Removal of Unstable Material

Where wet or otherwise unstable soil incapable of properly supporting the pipe, as determined by the Contracting Officer, is unexpectedly encountered in the bottom of a trench, such material shall be removed to the depth required and replaced to the proper grade with select granular material, compacted as provided in paragraph BACKFILLING. When removal of unstable material is due to the fault or neglect of the Contractor in his performance of shoring and sheeting, water removal, or other specified requirements, such removal and replacement shall be performed at no additional cost to the government.

### 3.2 BEDDING, HAUNCHING AND INITIAL BACKFILL

The bedding surface for the pipe shall provide a firm foundation of uniform

density throughout the entire length of the pipe.

### 3.2.1 Concrete Pipe Requirements

Select granular material and initial backfill shall be compacted to at least 90 percent maximum density and shall be placed in layers not exceeding 150 mm loose thickness for compaction by hand-operated machine compactors and 200 mm loose thickness for other than hand-operated machines. After the pipe has been properly bedded, select granular material, at a moisture content that will facilitate compaction, shall be placed along both sides of the pipe to the springline. The backfill shall be brought up evenly on both sides of pipe for the full length of pipe. The backfill shall be thoroughly compacted under the haunches of the pipe. Each layer shall be thoroughly compacted with mechanical tampers or rammers. Initial backfill material shall be placed from the springline of the pipe to at least 12 inches above the top of the pipe. Bell holes and depressions for joints shall be not more than the length, depth, and width required for properly making the particular type of joint.

### 3.2.2 Corrugated Metal Pipe

Bedding for corrugated metal pipe and pipe arch shall be in accordance with ASTM A 798/A 798M. Structure backfill material shall be granular material classified as either GW, GP, GM, GC, SW or SP. It is not required to shape the bedding to the pipe geometry. However, for pipe arches, the Contractor shall either shape the bedding to the relatively flat bottom arc or fine grade the foundation to a shallow v-shape.

### 3.2.3 Plastic Pipe

Bedding for PVC and PE pipe shall meet the requirements of ASTM D 2321. Bedding, haunching, and initial backfill shall be either Class IB or II material.

## 3.3 PLACING PIPE

Each pipe shall be thoroughly examined before being laid; defective or damaged pipe shall not be used. Plastic pipe shall be protected from exposure to direct sunlight prior to laying, if necessary to maintain adequate pipe stiffness and meet installation deflection requirements. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Pipe shall not be laid in water, and pipe shall not be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. Deflection of installed flexible pipe shall not exceed the following limits:

TYPE OF PIPE	MAXIMUM ALLOWABLE DEFLECTION (%)
Corrugated SteelAlloy	5
Plastic	7.5

Not less than 30 days after the completion of backfilling, the Government may perform a deflection test on the entire length of installed flexible

pipe using a mandrel or other suitable device. Installed flexible pipe showing deflections greater than those indicated above shall be retested by a run from the opposite direction. If the retest also fails, the suspect pipe shall be replaced at no cost to the Government.

### 3.3.1 Concrete, PVC, Ribbed PVC Pipe

Laying shall proceed upgrade with spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow.

### 3.3.2 Elliptical Reinforced Concrete Pipe

The manufacturer's reference lines, designating the top of the pipe, shall be within 5 degrees of a vertical plane through the longitudinal axis of the pipe, during placement. Damage to or misalignment of the pipe shall be prevented in all backfilling operations.

### 3.3.3 Corrugated PE Pipe

Laying shall be with the separate sections joined firmly on a bed shaped to line and grade and shall follow manufacturer's recommendations.

### 3.3.4 Corrugated Metal Pipe and Pipe Arch

Laying shall be with the separate sections joined firmly together, with the outside laps of circumferential joints pointing upstream, and with longitudinal laps on the sides. Lifting lugs shall be used to facilitate moving pipe without damage to exterior or interior coatings. During transportation and installation, pipe or pipe arch and coupling bands shall be handled with care to preclude damage to the coating, paving or lining. Damaged coatings, pavings and linings shall be repaired in accordance with the manufacturer's recommendations prior to placing backfill. Pipe on which coating has been damaged to such an extent that satisfactory field repairs cannot be made shall be removed and replaced.

### 3.3.5 Multiple Culverts

Where multiple corrugated metal arch pipes are installed, adjacent sides of pipe shall be at least one third the nominal pipe span.

## 3.4 JOINTING

### 3.4.1 Concrete Pipe

#### 3.4.1.1 Plastic Sealing Compound Joints for Tongue-and-Grooved Pipe

Sealing compounds shall follow the recommendation of the particular manufacturer in regard to special installation requirements. Surfaces to receive lubricants, primers, or adhesives shall be dry and clean. Sealing compounds shall be affixed to the pipe not more than 3 hours prior to installation of the pipe, and shall be protected from the sun, blowing dust, and other deleterious agents at all times. Sealing compounds shall be inspected before installation of the pipe, and any loose or improperly affixed sealing compound shall be removed and replaced. The pipe shall be aligned with the previously installed pipe, and the joint pulled together. If, while making the joint with mastic-type sealant, a slight protrusion of the material is not visible along the entire inner and outer circumference of the joint when the joint is pulled up, the pipe shall be removed and the joint remade. After the joint is made, all inner protrusions shall be cut

off flush with the inner surface of the pipe. If nonmastic-type sealant material is used, the "Squeeze-Out" requirement above will be waived.

#### 3.4.1.2 Flexible Watertight Joints

Gaskets and jointing materials shall be as recommended by the particular manufacturer in regard to use of lubricants, cements, adhesives, and other special installation requirements. Surfaces to receive lubricants, cements, or adhesives shall be clean and dry. Gaskets and jointing materials shall be affixed to the pipe not more than 24 hours prior to the installation of the pipe, and shall be protected from the sun, blowing dust, and other deleterious agents at all times. Gaskets and jointing materials shall be inspected before installing the pipe; any loose or improperly affixed gaskets and jointing materials shall be removed and replaced. The pipe shall be aligned with the previously installed pipe, and the joint pushed home. If, while the joint is being made the gasket becomes visibly dislocated the pipe shall be removed and the joint remade.

#### 3.4.2 Corrugated Metal Pipe

##### 3.4.2.1 Field Joints

Transverse field joints shall be designed so that the successive connection of pipe sections will form a continuous line free of appreciable irregularities in the flow line. In addition, the joints shall meet the general performance requirements described in ASTM A 798/A 798M. The space between the pipe and connecting bands shall be kept free from dirt and grit so that corrugations fit snugly. The connecting band, while being tightened, shall be tapped with a soft-head mallet of wood, rubber or plastic, to take up slack and ensure a tight joint. Field joints for each type of corrugated metal pipe shall maintain pipe alignment during construction and prevent infiltration of fill material during the life of the installations. The type, size, and sheet thickness of the band and the size of angles or lugs and bolts shall be as indicated or where not indicated, shall be as specified in the applicable standards or specifications for the pipe.

##### 3.4.2.2 Flexible Watertight, Gasketed Annular Band Joints

Installation shall be as recommended by the gasket manufacturer for use of lubricants and cements and other special installation requirements. The gasket shall be placed over one end of a section of pipe for half the width of the gasket. The other half shall be doubled over the end of the same pipe. When the adjoining section of pipe is in place, the doubled-over half of the gasket shall then be rolled over the adjoining section. Any unevenness in overlap shall be corrected so that the gasket covers the end of pipe sections equally. Connecting bands shall be centered over adjoining sections of pipe, and rods or bolts placed in position and nuts tightened. Band Tightening: The band shall be tightened evenly, even tension being kept on the rods or bolts, and the gasket; the gasket shall seat properly in the corrugations. Watertight joints shall remain uncovered for a period of time designated, and before being covered, tightness of the nuts shall be measured with a torque wrench. If the nut has tended to loosen its grip on the bolts or rods, the nut shall be retightened with a torque wrench and remain uncovered until a tight, permanent joint is assured.

#### 3.5 DRAINAGE STRUCTURES

### 3.5.1 Inlets

Construction shall be of reinforced concrete; complete with frames and gratings.

### 3.5.2 Headwalls

Construction shall be as indicated.

## 3.6 BACKFILLING

### 3.6.1 Final Backfill

The remainder of the trench above the initial backfill shall be backfilled in accordance with Section 02316a EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

### 3.6.2 Movement of Construction Machinery

When compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced.

### 3.6.3 Compaction

#### 3.6.3.1 General Requirements

Cohesionless materials include gravels, gravel-sand mixtures, sands, and gravelly sands. Cohesive materials include clayey and silty gravels, gravel-silt mixtures, clayey and silty sands, sand-clay mixtures, clays, silts, and very fine sands. When results of compaction tests for moisture-density relations are recorded on graphs, cohesionless soils will show straight lines or reverse-shaped moisture-density curves, and cohesive soils will show normal moisture-density curves.

#### 3.6.3.2 Minimum Density

Backfill over and around the pipe and backfill around and adjacent to drainage structures shall be compacted to a density of not less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material at the approved moisture content.

#### 3.6.4 Determination of Density

Testing shall be the responsibility of the Contractor and performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Tests shall be performed in sufficient number to ensure that specified density is being obtained. Laboratory tests for moisture-density relations shall be made in accordance with ASTM D 1557 except that mechanical tampers may be used provided the results are correlated with those obtained with the specified hand tamper. Field density tests shall be determined in accordance with ASTM D 2167 or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted, if necessary, using the sand cone method as described in paragraph Calibration of the referenced publications. ASTM D 2922 results in a wet unit weight of soil and when using this method ASTM D 3017 shall be used to determine

the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017 or ASTM D 2922. Test results shall be furnished the Contracting Officer. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed.

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## SECTION 02763A

## PAVEMENT MARKINGS

04/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS TT-P-1952

(Rev D; Canc. Notice 1) Paint, Traffic and  
Airfield Marking, Waterborne (Metric)

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-03 Product Data

Equipment; G-AO

Lists of proposed equipment, including descriptive data, and notifications of proposed Contractor actions as specified in this section. List of removal equipment shall include descriptive data indicating area of coverage per pass, pressure adjustment range, tank and flow capacities, and safety precautions required for the equipment operation.

## Composition Requirements

Manufacturer's current printed product description and Material Safety Data Sheets (MSDS) for each type paint/color proposed for use.

## Qualifications

Document certifying that personnel are qualified for equipment operation and handling of chemicals.

## SD-07 Certificates

Volatile Organic Compound (VOC)

Certificate stating that the proposed pavement marking paint meets the VOC regulations of the local Air Pollution Control District having jurisdiction over the geographical area in which

the project is located.

### 1.3 DELIVERY AND STORAGE

All materials shall be delivered and stored in sealed containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's name, and directions, all of which shall be plainly legible at time of use.

### 1.4 EQUIPMENT

All machines, tools and equipment used in the performance of the work shall be approved and maintained in satisfactory operating condition.

#### 1.4.1 Paint Application Equipment

All machines, tools, and equipment used in performance of the work shall be approved and maintained in satisfactory operating condition. Hand-operated push-type machines of a type commonly used for application of paint to pavement surfaces will be acceptable for marking small streets and parking areas. Applicator machine shall be equipped with the necessary paint tanks and spraying nozzles, and shall be capable of applying paint uniformly at coverage specified. Sandblasting equipment shall be provided as required for cleaning surfaces to be painted. Hand-operated spray guns shall be provided for use in areas where push-type machines cannot be used.

#### 1.4.2 Surface Preparation Equipment

##### 1.4.2.1 Sandblasting Equipment

Sandblasting equipment shall include an air compressor, hoses, and nozzles of proper size and capacity as required for cleaning surfaces to be painted. The compressor shall be capable of furnishing not less than 150 cfm of air at a pressure of not less than 90 psi at each nozzle used, and shall be equipped with traps that will maintain the compressed air free of oil and water.

##### 1.4.2.2 Waterblast Equipment

The water pressure shall be specified at 2600 psi at 140 degrees F in order to adequately clean the surfaces to be marked.

### 1.5 WEATHER LIMITATIONS FOR REMOVAL

Pavement surface shall be free of snow, ice, or slush. Surface temperature shall be at least 40 degrees F and rising at the beginning of operations, except those involving shot or sand blasting. Operation shall cease during thunderstorms. Operation shall cease during rainfall, except for waterblasting and removal of previously applied chemicals. Waterblasting shall cease where surface water accumulation alters the effectiveness of material removal.

## PART 2 PRODUCTS

### 2.1 PAINT

The paint shall be homogeneous, easily stirred to smooth consistency, and shall show no hard settlement or other objectionable characteristics during a storage period of 6 months. Paints shall conform to FS TT-P-1952, color

as indicated. Pavement marking paints shall comply with applicable state and local laws enacted to ensure compliance with Federal Clean Air Standards. Paint materials shall conform to the restrictions of the local Air Pollution Control District.

### PART 3 EXECUTION

#### 3.1 SURFACE PREPARATION

Surfaces to be marked shall be thoroughly cleaned before application of the pavement marking material. Dust, dirt, and other granular surface deposits shall be removed by sweeping, blowing with compressed air, rinsing with water or a combination of these methods as required. Rubber deposits, surface laitance, and other coatings adhering to the pavement shall be completely removed with scrapers, wire brushes, sandblasting, approved chemicals, or mechanical abrasion as directed. Areas of pavement affected with oil or grease shall be scrubbed with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinsed thoroughly after each application. After cleaning, oil-soaked areas shall be sealed with cut shellac to prevent bleeding through the new paint. Pavement surfaces shall be allowed to dry, when water is used for cleaning, prior to striping or marking. Surfaces shall be recleaned, when work has been stopped due to rain.

##### 3.1.1 Cleaning Concrete Curing Compounds

On new Portland cement concrete pavements, cleaning operations shall not begin until a minimum of 30 days after the placement of concrete. All new concrete pavements shall be cleaned by either sandblasting or water blasting. The extent of the blasting work shall be to clean and prepare the concrete surface as follows:

- a. There is no visible evidence of curing compound on the peaks of the textured concrete surface.
- b. There are no heavy puddled deposits of curing compound in the valleys of the textured concrete surface.
- c. All remaining curing compound is intact; all loose and flaking material is removed.
- d. The peaks of the textured pavement surface are rounded in profile and free of sharp edges and irregularities.
- e. The surface to be marked is dry.

#### 3.2 APPLICATION

All pavement markings and patterns shall be placed as shown on the plans.

##### 3.2.1 Paint

Paint shall be applied to clean, dry surfaces, and only when air and pavement temperatures are above 40 degrees F and less than 95 degrees F. Paint temperature shall be maintained within these same limits. New asphalt pavement surfaces and new Portland concrete cement shall be allowed to cure for a period of not less than 30 days before applications of paint.

Paint shall be applied pneumatically with approved equipment at rate of coverage specified. The Contractor shall provide guide lines and templates

as necessary to control paint application. Special precautions shall be taken in marking numbers, letters, and symbols. Edges of markings shall be sharply outlined.

#### 3.2.1.1 Rate of Application

Paint shall be applied evenly to the pavement surface to be coated at a rate of 105 plus or minus 5 square feet per gallon.

#### 3.2.1.2 Drying

The maximum drying time requirements of the paint specifications will be strictly enforced to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. If there is a delay in drying of the markings, painting operations shall be discontinued until cause of the slow drying is determined and corrected.

-- End of Section --

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03/98

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## SECTION 02770A

CONCRETE SIDEWALKS AND CURBS AND GUTTERS  
03/98

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO M 182 (1991) Burlap Cloth Made from Jute or Kenaf

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 31/C 31M (1996) Making and Curing Concrete Test Specimens in the Field

ASTM C 143 (1990a) Slump of Hydraulic Cement Concrete

ASTM C 171 (1997) Sheet Materials for Curing Concrete

ASTM C 172 (1997) Sampling Freshly Mixed Concrete

ASTM C 173 (1996) Air Content of Freshly Mixed Concrete by the Volumetric Method

ASTM C 231 (1997) Air Content of Freshly Mixed Concrete by the Pressure Method

ASTM C 309 (1997) Liquid Membrane-Forming Compounds for Curing Concrete

ASTM C 920 (1995) Elastomeric Joint Sealants

ASTM D 1751 (1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

ASTM D 1752 (1984; R 1996) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

ASTM D 3405 (1996) Joint Sealants, Hot-Applied, for Concrete and Asphalt Pavements

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation;

submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Concrete

Copies of certified delivery tickets for all concrete used in the construction.

SD-06 Test Reports

Field Quality Control; G-AO

Copies of all test reports within 24 hours of completion of the test.

1.3 WEATHER LIMITATIONS

1.3.1 Placing During Cold Weather

Concrete placement shall not take place when the air temperature reaches 40 degrees F and is falling, or is already below that point. Placement may begin when the air temperature reaches 35 degrees F and is rising, or is already above 40 degrees F. Provisions shall be made to protect the concrete from freezing during the specified curing period. If necessary to place concrete when the temperature of the air, aggregates, or water is below 35 degrees F, placement and protection shall be approved in writing.

Approval will be contingent upon full conformance with the following provisions. The underlying material shall be prepared and protected so that it is entirely free of frost when the concrete is deposited. Mixing water and aggregates shall be heated as necessary to result in the temperature of the in-place concrete being between 50 and 85 degrees F. Methods and equipment for heating shall be approved. The aggregates shall be free of ice, snow, and frozen lumps before entering the mixer. Covering and other means shall be provided for maintaining the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period.

1.3.2 Placing During Warm Weather

The temperature of the concrete as placed shall not exceed 85 degrees F except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. The placing temperature shall not exceed 95 degrees F at any time.

1.4 PLANT, EQUIPMENT, MACHINES, AND TOOLS

1.4.1 General Requirements

Plant, equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times. The equipment shall have the capability of producing the required product, meeting grade controls, thickness control and smoothness requirements as specified. Use of the equipment shall be discontinued if

it produces unsatisfactory results. The Contracting Officer shall have access at all times to the plant and equipment to ensure proper operation and compliance with specifications.

#### 1.4.2 Slip Form Equipment

Slip form paver or curb forming machine, will be approved based on trial use on the job and shall be self-propelled, automatically controlled, crawler mounted, and capable of spreading, consolidating, and shaping the plastic concrete to the desired cross section in 1 pass.

### PART 2 PRODUCTS

#### 2.1 CONCRETE

Concrete shall conform to the applicable requirements of Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE except as otherwise specified. Concrete shall have a minimum compressive strength of 3500 psi at 28 days. Maximum size of aggregate shall be 1-1/2 inches.

##### 2.1.1 Air Content

Mixtures shall have air content by volume of concrete of 5 to 7 percent, based on measurements made immediately after discharge from the mixer.

##### 2.1.2 Slump

The concrete slump shall be 2 inches plus or minus 1 inch where determined in accordance with ASTM C 143.

#### 2.2 CONCRETE CURING MATERIALS

##### 2.2.1 Impervious Sheet Materials

Impervious sheet materials shall conform to ASTM C 171, type optional, except that polyethylene film, if used, shall be white opaque.

##### 2.2.2 Burlap

Burlap shall conform to AASHTO M 182.

##### 2.2.3 White Pigmented Membrane-Forming Curing Compound

White pigmented membrane-forming curing compound shall conform to ASTM C 309, Type 2.

#### 2.3 CONCRETE PROTECTION MATERIALS

Concrete protection materials shall be a linseed oil mixture of equal parts, by volume, of linseed oil and either mineral spirits, naphtha, or turpentine. At the option of the contractor, commercially prepared linseed oil mixtures, formulated specifically for application to concrete to provide protection against the action of deicing chemicals may be used, except that emulsified mixtures are not acceptable.

#### 2.4 JOINT FILLER STRIPS

##### 2.4.1 Contraction Joint Filler for Curb and Gutter

Contraction joint filler for curb and gutter shall consist of hard-pressed fiberboard.

#### 2.4.2 Expansion Joint Filler, Premolded

Expansion joint filler, premolded, shall conform to ASTM D 1751 or ASTM D 1752, 1/2 inch thick, unless otherwise indicated.

### 2.5 JOINT SEALANTS

#### 2.5.1 Joint Sealant, Cold-Applied

Joint sealant, cold-applied shall conform to ASTM C 920, grey or stone color.

#### 2.5.2 Joint Sealant, Hot-Poured

Joint sealant, hot-poured shall conform to ASTM D 3405.

### 2.6 FORM WORK

Form work shall be designed and constructed to ensure that the finished concrete will conform accurately to the indicated dimensions, lines, and elevations, and within the tolerances specified. Forms shall be of wood or steel, straight, of sufficient strength to resist springing during depositing and consolidating concrete. Wood forms shall be surfaced plank, 2 inches nominal thickness, straight and free from warp, twist, loose knots, splits or other defects. Wood forms shall have a nominal length of 10 feet. Radius bends may be formed with 3/4 inch boards, laminated to the required thickness. Steel forms shall be channel-formed sections with a flat top surface and with welded braces at each end and at not less than two intermediate points. Ends of steel forms shall be interlocking and self-aligning. Steel forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers. Steel forms shall have a nominal length of 10 feet with a minimum of 3 welded stake pockets per form. Stake pins shall be solid steel rods with chamfered heads and pointed tips designed for use with steel forms.

#### 2.6.1 Sidewalk Forms

Sidewalk forms shall be of a height equal to the full depth of the finished sidewalk.

#### 2.6.2 Curb and Gutter Forms

Curb and gutter outside forms shall have a height equal to the full depth of the curb or gutter. The inside form of curb shall have batter as indicated and shall be securely fastened to and supported by the outside form. Rigid forms shall be provided for curb returns, except that benders or thin plank forms may be used for curb or curb returns with a radius of 10 feet or more, where grade changes occur in the return, or where the central angle is such that a rigid form with a central angle of 90 degrees cannot be used. Back forms for curb returns may be made of 1-1/2 inch benders, for the full height of the curb, cleated together. In lieu of inside forms for curbs, a curb "mule" may be used for forming and finishing this surface, provided the results are approved.

## PART 3 EXECUTION

### 3.1 SUBGRADE PREPARATION

The subgrade shall be constructed to the specified grade and cross section prior to concrete placement.

#### 3.1.1 Sidewalk Subgrade

The subgrade shall be tested for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.

#### 3.1.2 Curb and Gutter Subgrade

The subgrade shall be tested for grade and cross section by means of a template extending the full width of the curb and gutter. The subgrade shall be of materials equal in bearing quality to the subgrade under the adjacent pavement.

#### 3.1.3 Maintenance of Subgrade

The subgrade shall be maintained in a smooth, compacted condition in conformity with the required section and established grade until the concrete is placed. The subgrade shall be in a moist condition when concrete is placed. The subgrade shall be prepared and protected to produce a subgrade free from frost when the concrete is deposited.

### 3.2 FORM SETTING

Forms shall be set to the indicated alignment, grade and dimensions. Forms shall be held rigidly in place by a minimum of 3 stakes per form placed at intervals not to exceed 4 feet. Corners, deep sections, and radius bends shall have additional stakes and braces, as required. Clamps, spreaders, and braces shall be used where required to ensure rigidity in the forms. Forms shall be removed without injuring the concrete. Bars or heavy tools shall not be used against the concrete in removing the forms. Any concrete found defective after form removal shall be promptly and satisfactorily repaired. Forms shall be cleaned and coated with form oil each time before concrete is placed. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that with probable freezing temperatures, oiling is mandatory.

#### 3.2.1 Sidewalks

Forms for sidewalks shall be set with the upper edge true to line and grade with an allowable tolerance of 1/8 inch in any 10 foot long section. After forms are set, grade and alignment shall be checked with a 10 foot straightedge. Forms shall have a transverse slope as indicated. Side forms shall not be removed for 12 hours after finishing has been completed.

#### 3.2.2 Curbs and Gutters

The forms of the front of the curb shall be removed not less than 2 hours nor more than 6 hours after the concrete has been placed. Forms back of curb shall remain in place until the face and top of the curb have been finished, as specified for concrete finishing. Gutter forms shall not be removed while the concrete is sufficiently plastic to slump in any direction.

### 3.3 SIDEWALK CONCRETE PLACEMENT AND FINISHING

#### 3.3.1 Formed Sidewalks

Concrete shall be placed in the forms in one layer. When consolidated and finished, the sidewalks shall be of the thickness indicated. After concrete has been placed in the forms, a strike-off guided by side forms shall be used to bring the surface to proper section to be compacted. The concrete shall be consolidated with an approved vibrator, and the surface shall be finished to grade with a strike off.

### 3.3.2 Concrete Finishing

After straightedging, when most of the water sheen has disappeared, and just before the concrete hardens, the surface shall be finished with a wood float or darby to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. A scored surface shall be produced by brooming with a fiber-bristle brush in a direction transverse to that of the traffic, followed by edging.

### 3.3.3 Edge and Joint Finishing

All slab edges, including those at formed joints, shall be finished with an edger having a radius of 1/8 inch. Transverse joint shall be edged before brooming, and the brooming shall eliminate the flat surface left by the surface face of the edger. Corners and edges which have crumbled and areas which lack sufficient mortar for proper finishing shall be cleaned and filled solidly with a properly proportioned mortar mixture and then finished.

### 3.3.4 Surface and Thickness Tolerances

Finished surfaces shall not vary more than 5/16 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch.

## 3.4 CURB AND GUTTER CONCRETE PLACEMENT AND FINISHING

### 3.4.1 Formed Curb and Gutter

Concrete shall be placed to the section required in a single lift. Consolidation shall be achieved by using approved mechanical vibrators. Curve shaped gutters shall be finished with a standard curb "mule".

### 3.4.2 Curb and Gutter Finishing

Approved slipformed curb and gutter machines may be used in lieu of hand placement.

### 3.4.3 Concrete Finishing

Exposed surfaces shall be floated and finished with a smooth wood float until true to grade and section and uniform in texture. Floated surfaces shall then be brushed with a fine-hair brush with longitudinal strokes. The edges of the gutter and top of the curb shall be rounded with an edging tool to a radius of 1/2 inch. Immediately after removing the front curb form, the face of the curb shall be rubbed with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. The front curb surface, while still wet, shall be brushed in the same manner as the gutter and curb top. The top surface of gutter and entrance shall be finished to grade with a wood float.

#### 3.4.4 Joint Finishing

Curb edges at formed joints shall be finished as indicated.

#### 3.4.5 Surface and Thickness Tolerances

Finished surfaces shall not vary more than 1/4 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch.

### 3.5 SIDEWALK JOINTS

Sidewalk joints shall be constructed to divide the surface into rectangular areas. Transverse contraction joints shall be spaced as indicated and shall be continuous across the slab. Longitudinal contraction joints shall be constructed as indicated. Transverse expansion joints shall be installed at sidewalk returns and opposite expansion joints in adjoining curbs. Where the sidewalk is not in contact with the curb, transverse expansion joints shall be installed as indicated. Expansion joints shall be formed about structures and features which project through or into the sidewalk pavement, using joint filler of the type, thickness, and width indicated.

#### 3.5.1 Sidewalk Contraction Joints

The contraction joints shall be formed in the fresh concrete by cutting a groove in the top portion of the slab to a depth of at least one-fourth of the sidewalk slab thickness, using a jointer to cut the groove, or by sawing a groove in the hardened concrete with a power-driven saw, unless otherwise approved. Sawed joints shall be constructed by sawing a groove in the concrete with a 1/8 inch blade to the depth indicated. An ample supply of saw blades shall be available on the job before concrete placement is started, and at least one standby sawing unit in good working order shall be available at the jobsite at all times during the sawing operations.

#### 3.5.2 Sidewalk Expansion Joints

Expansion joints shall be formed with 1/2 inch joint filler strips. Joint filler shall be held in place with steel pins or other devices to prevent warping of the filler during floating and finishing. Immediately after finishing operations are completed, joint edges shall be rounded with an edging tool having a radius of 1/8 inch, and concrete over the joint filler shall be removed. At the end of the curing period, expansion joints shall be cleaned and filled with cold-applied joint sealant. The joint opening shall be thoroughly cleaned before the sealing material is placed. Sealing material shall not be spilled on exposed surfaces of the concrete. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 50 degrees F at the time of application of joint sealing material. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.

### 3.6 CURB AND GUTTER JOINTS

Curb and gutter joints shall be constructed at right angles to the line of curb and gutter.

#### 3.6.1 Contraction Joints

Contraction joints shall be constructed directly opposite contraction joints in abutting portland cement concrete pavements and spaced so that monolithic sections between curb returns will not be less than 5 feet nor greater than 15 feet in length. Contraction joints shall be constructed by means of 1/8 inch thick separators and of a section conforming to the cross section of the curb and gutter. Separators shall be removed as soon as practicable after concrete has set sufficiently to preserve the width and shape of the joint and prior to finishing.

### 3.6.2 Expansion Joints

Expansion joints shall be formed by means of preformed expansion joint filler material cut and shaped to the cross section of curb and gutter. Expansion joints shall be provided in curb and gutter directly opposite expansion joints of abutting portland cement concrete pavement, and shall be of the same type and thickness as joints in the pavement. Where curb and gutter do not abut portland cement concrete pavement, expansion joints at least 1/2 inch in width shall be provided as indicated on the drawings.

Expansion joints shall be sealed immediately following curing of the concrete or as soon thereafter as weather conditions permit. Expansion joints and the top 1 inch depth of curb and gutter contraction-joints shall be sealed with hot or cold-applied joint sealant. The joint opening shall be thoroughly cleaned before the sealing material is placed. Sealing material shall not be spilled on exposed surfaces of the concrete. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 50 degrees F at the time of application of joint sealing material. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.

## 3.7 CURING AND PROTECTION

### 3.7.1 General Requirements

Concrete shall be protected against loss of moisture and rapid temperature changes for at least 7 days from the beginning of the curing operation. Unhardened concrete shall be protected from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready for use before actual concrete placement begins. Protection shall be provided as necessary to prevent cracking of the pavement due to temperature changes during the curing period.

#### 3.7.1.1 Mat Method

The entire exposed surface shall be covered with 2 or more layers of burlap. Mats shall overlap each other at least 6 inches. The mat shall be thoroughly wetted with water prior to placing on concrete surface and shall be kept continuously in a saturated condition and in intimate contact with concrete for not less than 7 days.

#### 3.7.1.2 Impervious Sheeting Method

The entire exposed surface shall be wetted with a fine spray of water and then covered with impervious sheeting material. Sheets shall be laid directly on the concrete surface with the light-colored side up and overlapped 12 inches when a continuous sheet is not used. The curing medium shall not be less than 18-inches wider than the concrete surface to be cured, and shall be securely weighted down by heavy wood planks, or a bank of moist earth placed along edges and laps in the sheets. Sheets shall be satisfactorily repaired or replaced if torn or otherwise damaged

during curing. The curing medium shall remain on the concrete surface to be cured for not less than 7 days.

#### 3.7.1.3 Membrane Curing Method

A uniform coating of white-pigmented membrane-curing compound shall be applied to the entire exposed surface of the concrete as soon after finishing as the free water has disappeared from the finished surface. Formed surfaces shall be coated immediately after the forms are removed and in no case longer than 1 hour after the removal of forms. Concrete shall not be allowed to dry before the application of the membrane. If any drying has occurred, the surface of the concrete shall be moistened with a fine spray of water and the curing compound applied as soon as the free water disappears. Curing compound shall be applied in two coats by hand-operated pressure sprayers at a coverage of approximately 200 square feet per gallon for the total of both coats. The second coat shall be applied in a direction approximately at right angles to the direction of application of the first coat. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. If pinholes, abrasion, or other discontinuities exist, an additional coat shall be applied to the affected areas within 30 minutes. Concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied shall be resprayed by the method and at the coverage specified above. Areas where the curing compound is damaged by subsequent construction operations within the curing period shall be resprayed. Necessary precautions shall be taken to insure that the concrete is properly cured at sawed joints, and that no curing compound enters the joints. The top of the joint opening and the joint groove at exposed edges shall be tightly sealed before the concrete in the region of the joint is resprayed with curing compound. The method used for sealing the joint groove shall prevent loss of moisture from the joint during the entire specified curing period. Approved standby facilities for curing concrete pavement shall be provided at a location accessible to the jobsite for use in the event of mechanical failure of the spraying equipment or other conditions that might prevent correct application of the membrane-curing compound at the proper time. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected during the entire curing period from pedestrian and vehicular traffic, except as required for joint-sawing operations and surface tests, and from any other possible damage to the continuity of the membrane.

#### 3.7.2 Backfilling

After curing, debris shall be removed and the area adjoining the concrete shall be backfilled, graded, and compacted to conform to the surrounding area in accordance with lines and grades indicated.

#### 3.7.3 Protection

Completed concrete shall be protected from damage until accepted. The Contractor shall repair damaged concrete and clean concrete discolored during construction. Concrete that is damaged shall be removed and reconstructed for the entire length between regularly scheduled joints. Refinishing the damaged portion will not be acceptable. Removed damaged portions shall be disposed of as directed.

#### 3.7.4 Protective Coating

Protective coating of linseed oil mixture shall be applied to the exposed-to-view concrete surface.

#### 3.7.4.1 Application

Curing and backfilling operation shall be completed prior to applying two coats of protective coating. Concrete shall be surface dry and clean before each application. Coverage shall be by spray application at not more than 50 square yards per gallon for first application and not more than 70 square yards per gallon for second application, except that the number of applications and coverage for each application for commercially prepared mixture shall be in accordance with the manufacturer's instructions. Coated surfaces shall be protected from vehicular and pedestrian traffic until dry.

#### 3.7.4.2 Precautions

Protective coating shall not be heated by direct application of flame or electrical heaters and shall be protected from exposure to open flame, sparks, and fire adjacent to open containers or applicators. Material shall not be applied at ambient or material temperatures lower than 50 degrees F.

### 3.8 FIELD QUALITY CONTROL

#### 3.8.1 General Requirements

The Contractor shall perform the inspection and tests described and meet the specified requirements for inspection details and frequency of testing.

Based upon the results of these inspections and tests, the Contractor shall take the action and submit reports as required below, and any additional tests to insure that the requirements of these specifications are met.

#### 3.8.2 Concrete Testing

##### 3.8.2.1 Strength Testing

The Contractor shall provide molded concrete specimens for strength tests. Samples of concrete placed each day shall be taken not less than once a day nor less than once for every 250 cubic yards of concrete. The samples for strength tests shall be taken in accordance with ASTM C 172. Cylinders for acceptance shall be molded in conformance with ASTM C 31/C 31M by an approved testing laboratory. Each strength test result shall be the average of 2 test cylinders from the same concrete sample tested at 28 days, unless otherwise specified or approved. Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength, and no individual strength test result falls below the specified strength by more than 500 psi.

##### 3.8.2.2 Air Content

Air content shall be determined in accordance with ASTM C 173 or ASTM C 231.

ASTM C 231 shall be used with concretes and mortars made with relatively dense natural aggregates. Two tests for air content shall be made on randomly selected batches of each class of concrete placed during each shift. Additional tests shall be made when excessive variation in concrete workability is reported by the placing foreman or the Government inspector.

If results are out of tolerance, the placing foreman shall be notified and he shall take appropriate action to have the air content corrected at the plant. Additional tests for air content will be performed on each truckload of material until such time as the air content is within the tolerance specified.

#### 3.8.2.3 Slump Test

Two slump tests shall be made on randomly selected batches of each class of concrete for every 250 cubic yards, or fraction thereof, of concrete placed during each shift. Additional tests shall be performed when excessive variation in the workability of the concrete is noted or when excessive crumbling or slumping is noted along the edges of slip-formed concrete.

#### 3.8.3 Thickness Evaluation

The anticipated thickness of the concrete shall be determined prior to placement by passing a template through the formed section or by measuring the depth of opening of the extrusion template of the curb forming machine.

If a slip form paver is used for sidewalk placement, the subgrade shall be true to grade prior to concrete placement and the thickness will be determined by measuring each edge of the completed slab.

#### 3.8.4 Surface Evaluation

The finished surface of each category of the completed work shall be uniform in color and free of blemishes and form or tool marks.

### 3.9 SURFACE DEFICIENCIES AND CORRECTIONS

#### 3.9.1 Thickness Deficiency

When measurements indicate that the completed concrete section is deficient in thickness by more than 1/4 inch the deficient section will be removed, between regularly scheduled joints, and replaced.

#### 3.9.2 High Areas

In areas not meeting surface smoothness and plan grade requirements, high areas shall be reduced either by rubbing the freshly finished concrete with carborundum brick and water when the concrete is less than 36 hours old or by grinding the hardened concrete with an approved surface grinding machine after the concrete is 36 hours old or more. The area corrected by grinding the surface of the hardened concrete shall not exceed 5 percent of the area of any integral slab, and the depth of grinding shall not exceed 1/4 inch.

Pavement areas requiring grade or surface smoothness corrections in excess of the limits specified above shall be removed and replaced.

#### 3.9.3 Appearance

Exposed surfaces of the finished work will be inspected by the Government and any deficiencies in appearance will be identified. Areas which exhibit excessive cracking, discoloration, form marks, or tool marks or which are otherwise inconsistent with the overall appearances of the work shall be removed and replaced.

-- End of Section --

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## 06/01

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## SECTION 02811A

## UNDERGROUND SPRINKLER SYSTEMS

06/01

## PART 1 GENERAL

Complete irrigation system design and construction to irrigate all sodded lawns, trees, shrubs, groundcovers. All irrigation heads, nozzles, valves, and controllers shall be of the same manufacturer. Irrigation system shall also be designed and constructed to temporarily water seeded lawn areas with the use of quick coupler valves installed as part of the permanent system.

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53/A 53M	(1999b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 183	(1983; R 1998) Carbon Steel Track Bolts and Nuts
ASTM A 536	(1984; R 1999e1) Ductile Iron Castings
ASTM B 32	(1996) Solder Metal
ASTM B 43	(1998) Seamless Red Brass Pipe, Standard Sizes
ASTM B 88	(1999) Seamless Copper Water Tube
ASTM D 1785	(1999) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2000	(1999) Rubber Products in Automotive Applications
ASTM D 2241	(2000) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2464	(1999) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(1999) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2564	(1996a) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems

- ASTM D 2774 (1994) Underground Installation of Thermoplastic Pressure Piping
- ASTM D 2855 (1996) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
- ASTM F 441/F 441M (1999) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
- ASME INTERNATIONAL (ASME)
- ASME B1.2 (1983; R 1991; Errata May 1992) Gages and Gaging for Unified Inch Screw Threads
- ASME B16.3 (1998) Malleable Iron Threaded Fittings
- ASME B16.15 (1985; R 1994) Cast Bronze Threaded Fittings Classes 125 and 250
- ASME B16.18 (1984; R 1994) Cast Copper Alloy Solder Joint Pressure Fittings
- ASME B16.22 (1995; B16.22a1998) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
- ASME B40.1 (1991) Gauges - Pressure Indicating Dial Type - Elastic Element
- AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)
- ASSE 1013 (1999) Reduced Pressure Principle Backflow Preventers
- AMERICAN WATER WORKS ASSOCIATION (AWWA)
- AWWA C509 (1994; Addendum 1995) Resilient-Seated Gate Valves for Water Supply Service
- AWWA C606 (1997) Grooved and Shouldered Joints
- U.S. GENERAL SERVICES ADMINISTRATION (GSA)
- CID A-A-51145 (Rev C) Flux, Soldering, Non-Electronic, Paste & Liquid
- FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)
- FCCCHR-01 (1993) Manual of Cross-Connection Control
- MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)
- MSS SP-80 (1997) Bronze Gate, Globe, Angle and Check Valves
- MSS SP-85 (1994) Cast Iron Globe & Angle Valves Flanged and Threaded Ends

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- NEMA ICS 2 (1993) Industrial Control and Systems  
Controllers, Contactors, and Overload  
Relays Rated Not More Than 2,000 Volts AC  
or 750 Volts DC
- NEMA ICS 6 (1993) Industrial Control and Systems,  
Enclosures

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 70 (2002) National Electrical Code

## PLUMBING AND DRAINAGE INSTITUTE (PDI)

- PDI WH 201 (1992) Water Hammer Arresters

## 1.2 PERFORMANCE REQUIREMENTS

System shall operate with a minimum water pressure of 20730 psi at connection to base of the sprinkler head and 25 psi at the last head in each zone.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

## Sprinkler System; G-DO

Detail drawings for valves, sprinkler heads, backflow preventers, automatic controllers, emitter heads, and water hammer arresters. Drawings shall include a complete list of equipment and materials, and manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Drawings shall also contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will function as a unit. Drawings shall show proposed system layout, type and number of heads and emitters, quick coupler valves, zone valves, drain pockets, backflow devices, controllers, and mounting details of controllers. As-built Drawings which provide current factual information showing locations of mains, heads, valves, and controllers including deviations from and amendments to the drawings and changes in the work shall be included.

## SD-03 Product Data

## Spare Parts;

Spare parts data for each different item of material and equipment specified, after approval of the related submittals and

not later than the start of the field tests. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

#### Design Analysis and Calculations; G-DO

Design analyses and pressure calculations verifying that system will provide the irrigation requirements for all irrigation zones and sections controlled by valves.

#### SD-06 Test Reports

##### Field Tests;

Performance test reports, in booklet form, showing all field tests performed to adjust each component; and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of control valves.

#### SD-10 Operation and Maintenance Data

##### Sprinkler System;

TWO copies of operation and TWO copies of maintenance manuals for the equipment furnished. One complete set prior to field testing and the remainder upon acceptance. Manuals shall be approved prior to the field training course. Operating manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operating manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout, simplified wiring and control diagrams of the system as installed, and system programming schedule.

#### 1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be protected from the weather; excessive humidity and temperature variation; direct sunlight (in the case of plastic or rubber materials); and dirt, dust, or other contaminants.

#### 1.5 FIELD MEASUREMENTS

The Contractor shall verify all dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing the work.

### PART 2 PRODUCTS

#### 2.1 MATERIALS AND EQUIPMENT REQUIREMENTS

##### 2.1.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer who has produced similar systems which have performed well for a minimum

period of 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

#### 2.1.2 Nameplates

Each item of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

#### 2.1.3 Extra Stock

The following extra stock shall be provided: Two sprinkler heads of each size and type, two valve keys for operating manual valves, two wrenches for removing and installing each type of head, two quick coupler keys and hose swivels, and four irrigation controller housing keys.

### 2.2 PIPING MATERIALS

#### 2.2.1 Copper Tubing and Associated Fittings

Tubing shall conform to requirements of ASTM B 88, Type K. Fittings shall conform to ASME B16.22 and ASME B16.18, solder joint. Solder shall conform to ASTM B 32 95-5 tin-antimony. Flux shall conform to CID A-A-51145, Type I. Grooved mechanical joints and fittings shall be designed for not less than 125 psig service and shall be the product of the same manufacturer. Grooved fitting and mechanical coupling housing shall be ductile iron conforming to ASTM A 536. Gaskets for use in grooved joints shall be molded synthetic polymer of pressure responsive design and shall conform to ASTM D 2000 for circulating medium up to 230 degrees F. Grooved joints shall conform to AWWA C606. Coupling nuts and bolts for use in grooved joints shall be steel and shall conform to ASTM A 183.

#### 2.2.2 Red Brass Pipe and Associated Fittings

Pipe shall conform to requirements of ASTM B 43, regular. Fittings shall be Class 250, cast bronze threaded conforming to the requirements of ASME B16.15.

#### 2.2.3 Galvanized Steel Pipe and Associated Fittings

Pipe shall conform to requirements of ASTM A 53/A 53M, Schedule 40. Fittings shall be Class 150 conforming to requirements of ASME B16.3.

#### 2.2.4 Polyvinyl Chloride (PVC) Pipe, Fittings and Solvent Cement

##### 2.2.4.1 PVC Pipe

Pipe shall conform to the requirements of ASTM D 1785, PVC 1120 Schedule 80; or ASTM D 2241, PVC 1120 SDR 21, Class 200.

##### 2.2.4.2 PVC Fittings

Solvent welded socket type fittings shall conform to requirements of ASTM D 2466, Schedule 40. Threaded type fittings shall conform to requirements of ASTM D 2464, Schedule 80.

##### 2.2.4.3 Solvent Cement

Solvent cement shall conform to the requirements of ASTM D 2564.

#### 2.2.5 Dielectric Fittings

Dielectric fittings shall conform to ASTM F 441/F 441M, Schedule 80, CPVC threaded pipe nipples, 4 inch minimum length.

### 2.3 SPRINKLER AND BUBBLER HEADS

#### 2.3.1 Pop-Up Spray Heads

##### 2.3.1.1 General Requirements

Pop-up spray heads lay flush with housing, then pop up when water pressure 20 psi is activated in system. The rising member supporting the nozzle shall be identical on full, half, third or quarter pattern sprinklers so that nozzles will be interchangeable. The sprinkler head shall be designed to be adjustable for coverage and flow. The nozzle shall be removable so head does not have to be removed for flushing or cleaning. Nozzle rises a minimum of 4 inches above the body. The body shall be constructed with a 1/2 inch female thread for installation in a fixed underground pipe system.

##### 2.3.1.2 Pop-Up Sprinkler Heads

Stationary sprinkler heads shall be adjustable coverage and designed for pop-up at a height compatible with ground covers, shrubs, trees or lawns. Nozzles shall be pressure compensating, flood, stream or spray type nozzles specifically designed by the manufacturer for the watering trees, shrubs, groundcovers, and lawns. Stationary sprinkler heads, nozzles, and miscellaneous adapters shall be the same as or approved equal to Toro series 570. Micro spray nozzles are not approved products.

#### 2.3.2 Rotary Pop-Up Sprinklers

Sprinklers shall be capable of covering a 30 foot radius at 50 psi delivering 7.51 gallons per minute. Sprinkler shall pop-up and have a trajectory of 27 degrees. Construction shall be high impact molded plastic with filter screen, choice of nozzles and have adjustable radius capabilities. Pop-up sprinkler head shall be the same as or approved equal to Toro series 300 or 300XP.

#### 2.3.3 Bubbler Sprinkler Heads

Heads shall be multiple-spray bubbler with adjustable flow and designed for permanent aboveground mounting on risers. Heads shall be the same as or approved equal to Toro series 570 nozzles.

### 2.4 VALVES

#### 2.4.1 Gate Valves, Less than 3 Inches

Gate valves shall conform to the requirements of MSS SP-80, Type 1, Class 150, threaded ends.

#### 2.4.2 Gate Valves, 3 Inches and Larger

Gate valves shall conform to the requirements of AWWA C509 and have encapsulated resilient wedge, parallel seats, non-rising stems, and open by counterclockwise turning. End connections shall be flanged. Interior

construction of valves shall be bronze including stem containing a maximum 2 percent aluminum and maximum 16 percent zinc.

#### 2.4.3 Angle Valves, Less Than 2-1/2 Inches

Angle valves shall conform to the requirements of MSS SP-80, Type 3, Class 150 threaded ends.

#### 2.4.4 Angle Valves, 2-1/2 Inches and Larger

Angle valves shall conform to the requirements of MSS SP-85, Type II, Class 250 threaded ends.

#### 2.4.5 Quick Coupling Valves

Quick coupling valves shall have brass parts and shall be two-piece unit consisting of a coupler water seal valve assembly and a removable upper body to allow spring and key track to be serviced without shutdown of main. Lids shall be lockable vinyl with spring for positive closure on key removal.

#### 2.4.6 Remote Control Valves, Electrical

Remote control valves shall be solenoid actuated globe valves of 3/4 to 3 inch size, suitable for 24 volts, 60 cycle, and designed to provide for shut-off in event of power failure. Valve shall be cast bronze or brass or plastic housing suitable for service at 150 psi operating pressure with external flow control adjustment for shut-off capability, external plug at diaphragm chamber to enable manual operation, filter in control chamber to prevent valve body clogging with debris, durable diaphragm, and accessibility to internal parts without removing valve from system.

#### 2.4.7 Drain Valves

##### 2.4.7.1 Manual Valves

Manual valves shall conform to requirements of MSS SP-80, Type 3, Class 150 threaded ends for sizes less than 2-1/2 inches and MSS SP-85, Type II, Class 250 ends for sizes 2-1/2 inches and larger.

##### 2.4.7.2 Automatic Valves

Automatic valves shall be brass or plastic, spring loaded ball drip type, 150 pounds and threaded ends, designed to close at 6 foot pressure head with positive seal at 3 psi pressure or greater and be open to drain at less than 3 psi pressure.

#### 2.4.8 Pressure Regulating Master Valve

Pressure regulating master valve shall be automatic mechanical self-cleaning, self-purging control system having an adjustable pressure setting operated by a solenoid on alternating current with 0.40 amperes at 24 volts. Valve shall close slowly and be free of chatter in each diaphragm position, have manual flow stem to adjust closing speed and internal flushing, and one inlet tapping capable of being installed as a straight pattern valve. Body shall be cast bronze or brass with removable brass seat serviceable from top without removing valve body from system. Valve shall operate at 150 psi working pressure and pilot range from 10 to 125 psi.

#### 2.4.9 Backflow Preventers

Reduced pressure principle assemblies shall be tested, approved, and listed in accordance with FCCCHR-01. Reduced pressure principle backflow preventers shall be in accordance with ASSE 1013.

##### 2.4.9.1 Reduced Pressure Type Backflow Preventers

Backflow preventers shall be 150 pound flanged, bronze mounted gate valve and strainer, 304 stainless steel or bronze, internal parts. Total pressure drop through complete assembly shall be a maximum of 10 psi at rated flow. Piping shall be galvanized steel pipe and fittings. Strainers shall be bronze or brass construction with gasket caps. Units shall have 200-mesh stainless steel screen elements.

#### 2.5 ACCESSORIES AND APPURTENANCES

##### 2.5.1 Valve Keys for Manually Operated Valves

Valve keys shall be 1/2 inch diameter by 3 feet long, tee handles and keyed to fit valves.

##### 2.5.2 Valve Boxes and Concrete Pads

###### 2.5.2.1 Valve Boxes

Valve boxes shall be cast iron, plastic lockable, or precast concrete for each gate valve, manual control valve and remote control valve. Box sizes shall be adjustable for valve used. Word "IRRIGATION" shall be cast on cover. Shaft diameter of box shall be minimum 5-1/4 inches. Cast iron box shall have bituminous coating.

###### 2.5.2.2 Concrete Pads

Concrete pads shall be precast or cast-in-place reinforced concrete construction for reduced pressure type backflow preventers.

##### 2.5.3 Pressure Gauges

Pressure gauges shall conform to requirements of ASME B40.1, single style pressure gauge for water with 4-1/2 inch dial brass or aluminum case, bronze tube, gauge cock, pressure snubber, and siphon. Scale range shall be suitable for irrigation sprinkler systems.

##### 2.5.4 Service Clamps

Service clamps shall be bronze flat, double strap, with neoprene gasket or "O"-ring seal.

##### 2.5.5 Water Hammer Arresters

Water hammer arrester shall conform to the requirements of PDI WH 201; stainless steel construction with an encased and sealed bellows compression chamber.

#### 2.6 AUTOMATIC CONTROLLERS, ELECTRICAL

Controller shall conform to the requirements of NEMA ICS 2 with 120 -volt

single phase service, operating with indicated stations, and grounded chassis. Enclosure shall conform to NEMA ICS 6 Type 3R, with locking hinged cover, wall-mounted. Controller shall be programmed for various schedules by setting switches and dials equipped with the following features: A switch for each day of week for two schedules, allowing each station to be scheduled individually as to days of watering; a minute switch for each station with a positive increment range of 0 to 90 minutes OR 10 minutes to 9 hours, set time within one percent; a switch allowing selected schedules to be repeated after each completion of initial watering schedule and allowing each operation to be scheduled throughout a 24-hour day; a circuit breaker for surge protection; and circuit for a 9-volt rechargeable NiCad battery.

## 2.7 ELECTRICAL WORK

Wiring and rigid conduit for electrical power shall be in accordance with NFPA 70, and Section 16375A ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

## 2.8 CONCRETE MATERIALS

Concrete shall have a compressive strength of 2500 psi at 28 days as specified in Section 03300, CAST-IN-PLACE STRUCTURAL CONCRETE.

## 2.9 WATER SUPPLY MAIN MATERIALS

Tapping sleeves, service cut off valves, and connections to water supply mains shall be in accordance with Section 02510a WATER DISTRIBUTION SYSTEM.

## 2.10 INSULATING JOINTS

Insulating joints and dielectric fittings shall be in accordance with Section 02510a WATER DISTRIBUTION SYSTEM.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Sprinkler system shall be installed after site grading has been completed. Excavation, trenching, and backfilling for sprinkler system shall be in accordance with the applicable provisions of Section 02316a, EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS, except as modified herein.

#### 3.1.1 Trenching

Trench around roots shall be hand excavated to pipe grade when roots of 2 inches diameter or greater are encountered. Trench width shall be 4 inches minimum or 1-1/2 times diameter of pipe, whichever is wider. Backfill shall be hand tamped over excavation. When rock is encountered, trench shall be excavated 4 inches deeper and backfilled with silty sand (SM) or well-graded sand (SW) to pipe grade. Trenches shall be kept free of obstructions and debris that would damage pipe. Subsoil shall not be mixed with topsoil. Existing concrete walks, drives and other obstacles shall be bored at a depth conforming to bottom of adjacent trenches. Pipe sleeves for bored pipe shall be two pipe diameters larger than sprinkler pipe.

#### 3.1.2 Piping System

##### 3.1.2.1 Cover

Underground piping shall be installed to meet the minimum depth of backfill cover specified.

#### 3.1.2.2 Clearances

Minimum horizontal clearances between lines shall be 4 inches for pipe 2 inches and less; 12 inches for 2-1/2 inches and larger. Minimum vertical clearances between lines shall be 1 inch.

#### 3.1.2.3 Minimum Slope

Minimum slope shall be 6 inches per 100 feet in direction of drain valves.

#### 3.1.3 Piping Installation

##### 3.1.3.1 Polyvinyl Chloride (PVC) Pipe

a. Solvent-cemented joints shall conform to the requirements of ASTM D 2855.

b. Threaded joints shall be full cut with a maximum of three threads remaining exposed on pipe and nipples. Threaded joints shall be made tight without recourse to wicks or fillers, other than polytetrafluoroethylene thread tape.

c. Piping shall be joined to conform with requirements of ASTM D 2774 or ASTM D 2855, and pipe manufacturer's instructions. Pipe shall be installed in a serpentine (snaked) manner to allow for expansion and contraction in trench before backfilling. Pipes shall be installed at temperatures over 40 degrees F.

##### 3.1.3.2 Soldered Copper Tubing

Pipe shall be reamed and burrs removed. Contact surfaces of joint shall be cleaned and polished. Flux shall be applied to male and female ends. End of tube shall be inserted into fittings full depth of socket. After soldering, a solder bead shall show continuously around entire joint circumference. Excess acid flux shall be removed from tubings and fittings.

##### 3.1.3.3 Threaded Brass or Galvanized Steel Pipe

Prior to installation, pipe shall be reamed. Threads shall be cut in conformance with ASME B1.2. Pipe joint compound shall be applied to male end only.

##### 3.1.3.4 Insulating Joints

Insulating and dielectric fittings shall be provided where pipes of dissimilar metal are joined and at connections to water supply mains as shown. Installation shall be in accordance with Section 02510a WATER DISTRIBUTION SYSTEM.

##### 3.1.3.5 Grooved Mechanical Joints

Grooves shall be prepared according to the coupling manufacturer's instructions. Grooved fittings, couplings, and grooving tools shall be products of the same manufacturer. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge,

vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with the coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations.

### 3.1.4 Installation of Valves

#### 3.1.4.1 Manual Valves

Valves shall be installed in a valve box extending from grade to below valve body, with a minimum of 4 inches cover measured from finish grade to top of valve stem. Valve boxes shall be located in mulched areas. All quick coupler valves shall be located in valve boxes.

#### 3.1.4.2 Automatic Valves

Valve shall be set plumb in a valve box extending from grade to below valve body, with minimum of 4 inch cover measured from grade to top of valve. Automatic valves shall be installed beside sprinkler heads with a valve box.

#### 3.1.4.3 Drain Valves

Entire system shall be manually or automatically drainable. Low points of system shall be equipped with drain valve draining into an excavation containing 1 cubic foot gravel. Gravel shall be covered with building paper then backfilled with excavated material and 6 inches of topsoil.

### 3.1.5 Sprinklers and Quick Coupling Valves

Sprinklers and valves shall be installed plumb and level with terrain. Bubbler heads shall be permanently installed 75mm to 100mm above mulch bed material for shrubs and trees and within the backfilled area adjacent to the root ball. Trees shall have a minimum of two to three bubblers per tree and shrubs a minimum of one bubbler per shrub. Junipers, groundcovers and ornamental grasses shall be sprinkler watered with pop-up type heads which rise above the material when watered. Lawn grasses shall be sprinkler watered with the largest radius spray heads that space permits. Keep the spacing between heads as uniform as possible. Space heads in a triangular spacing pattern for best coverage. Use head to head spacing for the heads as recommended by the manufacturer. Heads shall be placed in corner areas. Install heads with an adjustable radius to reduce the radius from those recommended by the manufacturer. Use the appropriate type nozzles for the space to be sprinkled. Place sprinklers so that sprays do not spray onto walks, drives, or pavements. Use similar type and pressure sprinkler heads on each section controlled by a valve.

### 3.1.6 Backflow Preventers

Backflow preventers shall be installed in new connection to existing water distribution system, between connection and control valves. Backflow preventers shall be installed with concrete pads.

#### 3.1.6.1 Reduced Pressure Type

Pipe lines shall be flushed prior to installing reduced pressure device; device shall be protected by a strainer located upstream. Device shall not be installed in pits or where any part of device could become submerged in

standing water.

### 3.1.7 Control Wire and Conduit

#### 3.1.7.1 Wires

Low voltage wires may be buried beside pipe in same trench. Rigid conduit shall be provided where wires run under paving. Wires shall be number tagged at key locations along main to facilitate service. One control circuit shall be provided for each zone and a circuit to control sprinkler system.

#### 3.1.7.2 Loops

A 12 inch loop of wire shall be provided at each valve where controls are connected.

#### 3.1.7.3 Expansion and Contraction

Multiple tubes or wires shall be bundled and taped together at 10 foot intervals with 12 inch loop for expansion and contraction.

#### 3.1.7.4 Splices

Electrical splices shall be waterproof.

### 3.1.8 Automatic Controller

Exact field location of controllers shall be determined before installation. Coordinate the electrical service to these locations. Install in accordance with manufacturer's recommendations and NFPA 70.

### 3.1.9 Thrust Blocks

Concrete shall be placed so that sides subject to thrust or load are against undisturbed earth, and valves and fittings are serviceable after concrete has set. Thrust blocks shall be as specified in Section 02510a WATER DISTRIBUTION SYSTEM.

### 3.1.10 Backfill

#### 3.1.10.1 Minimum Cover

Depth of cover shall be 12 inches for 1-1/4 inch pipe or smaller; 18 inches for 1-1/2 to 2 inch pipe; 24 inches for 2-1/2 inch pipe or larger; 36 inches for pipes under traffic loads, farm operations, and freezing temperatures; and 18 inches for low-voltage wires. Remainder of trench or pipe cover shall be filled to within 3 inches of top with excavated soil, and compact soil with plate hand-held compactors to same density as undisturbed adjacent soil.

#### 3.1.10.2 Restoration

Top 3 inches shall be filled with topsoil and compacted with same density as surrounding soil. Lawns and plants shall be restored in accordance with Sections 02921a SEEDING.

### 3.1.11 Adjustment

After grading, seeding, and rolling of planted areas, sprinkler heads shall be adjusted flush with finished grade. Adjustments shall be made by providing new nipples of proper length or by use of heads having an approved device, integral with head, which will permit adjustment in height of head without changing piping.

#### 3.1.12 Disinfection

Sprinkler system fed from a potable water system shall be disinfected upstream of backflow preventer in accordance with Section 02510a WATER DISTRIBUTION SYSTEM.

#### 3.1.13 Cleaning of Piping

Prior to the hydrostatic and operation tests, the interior of the pipe shall be flushed with clean water until pipe is free of all foreign materials. Flushing and cleaning out of system pipe, valves, and components shall not be considered completed until witnessed and accepted by Contracting Officer.

### 3.2 FIELD TESTS

All instruments, equipment, facilities, and labor required to conduct the tests shall be provided by Contractor.

#### 3.2.1 Hydrostatic Pressure Test

Piping shall be tested hydrostatically before backfilling and proved tight at a hydrostatic pressure of 150 psi without pumping for a period of one hour with an allowable pressure drop of 5 psi. If hydrostatic pressure cannot be held for a minimum of 4 hours, Contractor shall make adjustments or replacements and the tests repeated until satisfactory results are achieved and accepted by the Contracting Officer.

#### 3.2.2 Operation Test

At conclusion of pressure test, sprinkler heads or emitter heads, quick coupling assemblies, and hose valves shall be installed and entire system tested for operation under normal operating pressure. Operation test consists of the system operating through at least one complete programmed cycle for all areas to be sprinkled.

### 3.3 FRAMED INSTRUCTIONS

Framed instructions containing wiring and control diagrams under glass or in laminated plastic shall be posted where directed. Condensed operating instructions, prepared in typed form, shall be framed as specified above and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the system. After as-built drawings are approved by Contracting Officer, controller charts and programming schedule shall be prepared. One chart for each controller shall be supplied. Chart shall be a reduced drawing of actual as-built system that will fit the maximum dimensions inside controller housing. Black line print for chart and a different pastel or transparent color shall indicate each station area of coverage. After chart is completed and approved for final acceptance, chart shall be sealed between two 20 mil pieces of clear plastic.

### 3.4 FIELD TRAINING

A field training course shall be provided for designated operating and maintenance staff members. Training shall be provided for a total period of 2 hours of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the items contained in the operating and maintenance manuals.

### 3.5 CLEANUP

Upon completion of installation of system, all debris and surplus materials resulting from the work shall be removed.

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## SECTION 02821A

FENCING  
02/02

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 116	(2000) Metallic-Coated, Steel Woven Wire Fence Fabric
ASTM A 121	(1999) Zinc-Coated (Galvanized) Steel Barbed Wire
ASTM A 153/A 153M	(2001) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 392	(1996) Zinc-Coated Steel Chain-Link Fence Fabric
ASTM A 491	(1996) Aluminum-Coated Steel Chain-Link Fence Fabric
ASTM A 780	(2000) Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings
ASTM A 824	(1995) Metallic-Coated Steel Marcellled Tension Wire for Use With Chain Link Fence
ASTM C 94/C 94M	(2000e2) Ready-Mixed Concrete
ASTM F 1043	(2000) Strength and Protective Coatings on Metal Industrial Chain-Link Fence Framework
ASTM F 1083	(1997) Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures
ASTM F 1184	(1994) Industrial and Commercial Horizontal Slide Gates
ASTM F 626	(1996a) Fence Fittings
ASTM F 883	(1997) Padlocks
ASTM F 900	(1994) Industrial and Commercial Swing Gates

## AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C1	(2000) All Timber Products - Preservative Treatment by Pressure Processes
AWPA C4	(1999) Poles - Preservative Treatment by Pressure Processes

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### SD-07 Certificates

#### Chain Link Fence

Statement, signed by an official authorized to certify on behalf of the manufacturer, attesting that the chain link fence and component materials meet the specified requirements.

#### Ornamental Steel Fence

Statement, signed by an official authorized to certify on behalf of the manufacturer, attesting that the ornamental steel fence and component materials meet the specified requirements

## PART 2 PRODUCTS

### 2.1 FENCE FABRIC

Fence fabric shall conform to the following:

#### 2.1.1 Chain Link Fence Fabric

ASTM A 392, Class 2, zinc-coated steel wire with minimum coating weight of 2.0 ounces of zinc per square foot of coated surface, or ASTM A 491, Type I, aluminum-coated steel wire. Fabric shall be fabricated of 9 gauge wire woven in 2 inch mesh. Fabric height shall be as shown. Fabric shall be twisted and barbed on the top selvage and knuckled on the bottom selvage.

#### 2.1.2 Woven Wire

Woven wire shall conform to ASTM A 116 Design No. 1047-6-11 with Class 1 coating.

### 2.2 CHAIN LINK GATES

ASTM F 900 and/or ASTM F 1184. Gate shall be the type and swing shown. Gate frames shall conform to strength and coating requirements of ASTM F 1083 for Group IA, steel pipe, with external coating Type A, nominal pipe size (NPS) 1-1/2. Gate frames shall conform to strength and coating requirements of ASTM F 1043, for Group IC, steel pipe with external coating Type A or Type B, nominal pipe size (NPS) 1-1/2. Gate fabric shall be as specified for chain link fabric. Gate leaves more than 8 feet wide shall have either intermediate members and diagonal truss rods or shall have

tubular members as necessary to provide rigid construction, free from sag or twist. Gate leaves less than 8 feet wide shall have truss rods or intermediate braces. Gate fabric shall be attached to the gate frame by method standard with the manufacturer except that welding will not be permitted. Latches, hinges, stops, keepers, and other hardware items shall be furnished as required for the operation of the gate. Latches shall be arranged for padlocking so that the padlock will be accessible from both sides of the gate. Stops shall be provided for holding the gates in the open position.

## 2.3 POSTS

### 2.3.1 Metal Posts for Chain Link Fence

ASTM F 1083, zinc-coated. Group IA, with external coating Type A steel pipe. Group IC steel pipe, zinc-coated with external coating Type A or Type B and Group II, roll-formed steel sections, shall meet the strength and coating requirements of ASTM F 1043. Group III, ASTM F 1043 steel H-section may be used for line posts in lieu of line post shapes specified for the other classes. Sizes shall be as shown on the drawings. Line posts and terminal (corner, gate, and pull) posts selected shall be of the same designation throughout the fence. Gate post shall be for the gate type specified subject to the limitation specified in ASTM F 900 and/or ASTM F 1184.

### 2.3.2 Wood Fence Posts and Braces for Deer Fence

Posts, braces and wood stays shall be made from well-seasoned, sound, and straight-grained Western Larch, Lodgepole Pine, Ponderosa Pine, or Douglas Fir. Posts shall be free of ring shake, season cracks more than 1/4 inch wide, splits in the end, and unsound knots. All bark shall be removed from posts. Posts shall be treated in accordance with AWPA C1 or AWPA C4 as applicable. Braces and wood stays shall be untreated.

## 2.4 BRACES AND RAILS FOR CHAIN LINK FENCE

ASTM F 1083, zinc-coated, Group IA, steel pipe, size NPS 1-1/4. Group IC steel pipe, zinc-coated, shall meet the strength and coating requirements of ASTM F 1043. Group II, formed steel sections, size 1-21/32 inch, conforming to ASTM F 1043, may be used as braces and rails if Group II line posts are furnished.

## 2.5 WIRE

### 2.5.1 Tension Wire

Tension wire shall be Type I or Type II, Class 2 coating, in accordance with ASTM A 824.

### 2.5.2 Barbed Wire for Deer Fence

Barbed wire shall conform to ASTM A 121 design number 12-4-5-14R, metallic coated Type Z.

## 2.6 ACCESSORIES FOR CHAIN LINK FENCE

ASTM F 626. Ferrous accessories shall be zinc or aluminum coated. Truss rods shall be furnished for each terminal post. Truss rods shall be provided with turnbuckles or other equivalent provisions for adjustment.

Tie wire for attaching fabric to rails, braces, and posts shall be 9 gauge steel wire and match the coating of the fence fabric. Miscellaneous hardware coatings shall conform to ASTM A 153/A 153M unless modified.

## 2.7 ORNAMENTAL STEEL FENCE

Posts shall be 2-1/2 inch or 3 inch square 12 gauge tubular steel. Pickets shall be 1 inch square 14 gauge tubular steel. Rails shall be steel "U" channel or approved equal. Steel for posts, rails and pickets shall have a minimum yield strength of 45,000 psi. Steel posts, pickets and rails shall be galvanized and given a polyester powder coat finish as recommended by the manufacturer. The color shall be bronze.

## 2.8 CONCRETE

ASTM C 94/C 94M, using 3/4 inch maximum size aggregate, and having minimum compressive strength of 3000 psi at 28 days.

## 2.9 PADLOCKS

Padlocks shall conform to ASTM F 883, Type P01, Options A, B, and G, Grade 6, Size 1-3/4 inch. All padlocks shall be keyed alike. All padlocks shall be keyed into master key system as specified in Section 08710 DOOR HARDWARE.

# PART 3 EXECUTION

## 3.1 INSTALLATION

Fence shall be installed to the lines and grades indicated. Line posts shall be spaced equidistant at intervals shown on the drawings. Terminal (corner, gate, and pull) posts for chain link and deer fence shall be set at abrupt changes in vertical and horizontal alignment. Chain link fabric shall be continuous between terminal posts; however, runs between terminal posts shall not exceed 500 feet. Any damage to galvanized surfaces, including welding, shall be repaired with paint containing zinc dust in accordance with ASTM A 780.

## 3.2 EXCAVATION

Post holes shall be cleared of loose material. Waste material shall be spread where directed. The ground surface irregularities along the fence line shall be eliminated to the extent necessary to maintain a 2 inch clearance between the bottom of the fabric or pickets and finish grade.

## 3.3 POST INSTALLATION

### 3.3.1 Posts for Chain Link Fence

Posts shall be set plumb and in alignment. Posts for chain link and ornamental steel fence shall be set in concrete to the depth indicated on the drawings. Posts set in concrete shall be set in holes not less than the diameter shown on the drawings. Concrete shall be allowed to cure for 72 hours prior to attachment of any item to the posts.

### 3.3.2 Posts for Deer Fence

For wood posts, the Contractor shall excavate to depth indicated and brace post until backfill is completed. Backfill shall be placed in layers of 9 inches or less, moistened to optimum condition, and compacted with hand

tampers or other approved method. Posts shall be set plumb and in proper alignment.

### 3.4 RAILS

#### 3.4.1 Top Rail

Top rail shall be supported at each post to form a continuous brace between terminal posts. Where required, sections of top rail shall be joined using sleeves or couplings that will allow expansion or contraction of the rail.

### 3.5 BRACES AND TRUSS RODS

Braces and truss rods shall be installed as indicated and in conformance with the standard practice for the fence furnished. Horizontal (compression) braces and diagonal truss (tension) rods shall be installed on fences over 6 feet in height. Braces and truss rods shall extend from terminal posts to line posts. Diagonal braces shall form an angle of approximately 40 to 50 degrees with the horizontal. No bracing is required on fences 6 feet high or less if a top rail is installed.

### 3.6 TENSION WIRES

Tension wire shall be installed along the bottom of the chain link fence line and attached to the terminal posts of each stretch of the fence. Bottom tension wire shall be installed within the bottom 6 inches of the installed fabric. Tension wire shall be pulled taut and shall be free of sag.

### 3.7 CHAIN LINK FABRIC

Chain link fabric shall be installed on the side of the post indicated. Fabric shall be attached to terminal posts with stretcher bars and tension bands. Bands shall be spaced at approximately 15 inch intervals. The fabric shall be installed and pulled taut to provide a smooth and uniform appearance free from sag, without permanently distorting the fabric diamond or reducing the fabric height. Fabric shall be fastened to line posts at approximately 15 inch intervals and fastened to all rails and tension wires at approximately 24 inch intervals. Fabric shall be cut by untwisting and removing pickets. Splicing shall be accomplished by weaving a single picket into the ends of the rolls to be joined. The bottom of the installed fabric shall be 2 plus or minus 1/2 inch above the ground.

### 3.8 GATE INSTALLATION

Gates shall be installed at the locations shown. Hinged gates shall be mounted to swing as indicated. Latches, stops, and keepers shall be installed as required. Padlocks shall be attached to gates or gate posts with chains. Hinge pins, and hardware shall be welded or otherwise secured to prevent removal.

### 3.9 GROUNDING

Chain link, deer fence and ornamental steel fences crossed by powerlines of 600 volts or more shall be grounded at or near the point of crossing and at distances not exceeding 150 feet on each side of crossing. Ground conductor shall consist of No. 8 AWG solid copper wire. Grounding electrodes shall be 3/4 inch by 10 foot long copper-clad steel rod. Electrodes shall be driven into the earth so that the top of the electrode

is at least 6 inches below the grade. Where driving is impracticable, electrodes shall be buried a minimum of 12 inches deep and radially from the fence. The top of the electrode shall be not less than 2 feet or more than 8 feet from the fence. Ground conductor shall be clamped to the fence and electrodes with bronze grounding clamps to create electrical continuity between fence posts, fence fabric, and ground rods. After installation the total resistance of fence to ground shall not be greater than 25 ohms.

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SECTION 02921A

SEEDING  
05/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

U.S. DEPARTMENT OF AGRICULTURE (USDA)

AMS Seed Act (1995) Federal Seed Act Regulations Part 201

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 5268 (1992; R 1996) Topsoil Used for Landscaping Purposes

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

- Equipment;
- Surface Erosion Control Material;
- Chemical Treatment Material;

Manufacturer's literature including physical characteristics, application and installation instructions for equipment, surface erosion control material and chemical treatment material.

A listing of equipment to be used for the seeding operation.

Delivery;

Delivery schedule.

Finished Grade and Topsoil;

Finished grade status.

Topsoil;

Availability of topsoil from the stripping and stock piling operation.

Quantity Check;

Bag count or bulk weight measurements of material used compared with area covered to determine the application rate and quantity installed.

Seed Establishment Period;

Calendar time period for the seed establishment period. When there is more than one seed establishment period, the boundaries of the seeded area covered for each period shall be described.

Maintenance Record;

Maintenance work performed, area repaired or reinstalled, diagnosis for unsatisfactory stand of grass plants.

Application of Pesticide;

Pesticide treatment plan with sequence of treatment work with dates and times. The pesticide trade name, EPA registration number, chemical composition, formulation, concentration of original and diluted material, application rate of active ingredients, method of application, area treated, amount applied; and the name and state license number of the state certified applicator shall be included.

SD-04 Samples

Delivered Topsoil;

Samples taken from several locations at the source.

Soil Amendments;

A 10 pound sample.

Mulch;

A 10 pound sample.

SD-06 Test Reports

Equipment Calibration;

Certification of calibration tests conducted on the equipment used in the seeding operation.

SD-07 Certificates

- Seed;
- Topsoil;
- Fertilizer;
- Organic Material;
- Mulch;
- Pesticide;

Prior to the delivery of materials, certificates of compliance

attesting that materials meet the specified requirements. Certified copies of the material certificates shall include the following:

- a. Seed. Classification, botanical name, common name, percent pure live seed, minimum percent germination and hard seed, maximum percent weed seed content, and date tested.
- b. Topsoil. Particle size, pH, organic matter content, textural class, soluble salts, chemical and mechanical analyses.
- c. Fertilizer. Chemical analysis and composition percent.
- d. Organic Material: Composition and source.
- e. Mulch: Composition and source.
- f. Pesticide. EPA registration number and registered uses.

### 1.3 SOURCE INSPECTION

The source of delivered topsoil shall be subject to inspection.

### 1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING

#### 1.4.1 Delivery

A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery.

##### 1.4.1.1 Delivered Topsoil

Prior to the delivery of any topsoil, its availability shall be verified in paragraph TOPSOIL.

##### 1.4.1.2 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

##### 1.4.1.3 Pesticides

Pesticide material shall be delivered to the site in the original, unopened containers bearing legible labels indicating the EPA registration number and the manufacturer's registered uses.

#### 1.4.2 Inspection

Seed shall be inspected upon arrival at the job site for conformity to species and quality. Seed that is wet, moldy, or bears a test date five months or older, shall be rejected. Other materials shall be inspected for compliance with specified requirements. The following shall be rejected: open soil amendment containers or wet soil amendments; topsoil that contains slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 1-1/2 inch diameter; and topsoil that contains viable plants and plant parts. Unacceptable materials shall be removed from the job site.

1.4.3 Storage

Materials shall be stored in designated areas. Seed, and fertilizer shall be stored in cool, dry locations away from contaminants. Material shall be stored according to manufacturer's instructions and not with seeding operation materials.

1.4.4 Handling

Except for bulk deliveries, materials shall not be dropped or dumped from vehicles.

1.4.5 Time Limitation

Hydroseeding time limitation for holding seed in the slurry shall be a maximum 24 hours.

PART 2 PRODUCTS

2.1 SEED

2.1.1 Seed Classification

State-certified seed of the latest season's crop shall be provided in original sealed packages bearing the producer's guaranteed analysis for percentages of mixture, purity, germination, hard seed, weed seed content, and inert material. Labels shall be in conformance with AMS Seed Act and applicable state seed laws.

2.1.2 Permanent Seed Species and Mixtures

Permanent seed species and mixtures shall be proportioned by weight as follows:

Lawn Grass Seeding

Name	Percent of Mixture	Pounds/1,000 Sq.Ft.
Turf Type Tall Fescue	100	6.0

Short Field Grass Field Seeding

Name	Percent of Mixture	Pounds/1,000 Sq.Ft.
Sheep Fescue 'Covar'	48	1.2
Blue grama grass 'Alma'	25	0.6
Buffalo grass 'Tatanka'	3	0.1
Annual Ryegrass	24	<u>0.6</u>
	Total	2.5

2.1.3 Temporary Seed Species

Temporary seed species for surface erosion control shall be Annual Rye seeded at a rate of 10 pounds per acre.

2.1.4 Quality

Weed seed shall be a maximum 1 percent by weight of the total mixture.

### 2.1.5 Seed Mixing

The mixing of seed may be done by the seed supplier prior to delivery, or on site as directed.

### 2.1.6 Substitutions

Substitutions will not be allowed without written request and approval from the Contracting Officer.

## 2.2 TOPSOIL

Topsoil shall be as defined in ASTM D 5268. When available, the topsoil shall be the existing surface soil stripped and stockpiled onsite. When additional topsoil is required beyond the available topsoil from the stripping operation, topsoil shall be delivered and amended for the seed specified. Topsoil shall be free from slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 1-1/2 inch diameter. Topsoil shall be free from viable plants and plant parts.

## 2.3 SOIL AMENDMENTS

Soil amendments shall consist of fertilizer, and organic material meeting the following requirements. Vermiculite shall not be used.

### 2.3.1 Fertilizer

Fertilizer shall be controlled release commercial grade, free flowing, uniform in composition, and consist of a nitrogen-phosphorus-potassium ratio of 16-48-0. The fertilizer shall be derived from sulphur coated urea, urea formaldehyde, plastic or polymer coated pills, or isobutylenediurea (IBDU). Fertilizer shall be balanced with the inclusion of trace minerals and micro-nutrients.

### 2.3.2 Organic Material

Organic material shall consist of either rotted manure, decomposed wood derivatives.

#### 2.3.2.1 Rotted Manure

Rotted manure shall be unleached horse, or cattle manure containing a maximum 25 percent by volume of straw, sawdust, or other bedding materials. It shall contain no chemicals or ingredients harmful to plants. The manure shall be heat treated to kill weed seeds and be free of stones, sticks, and soil.

#### 2.3.2.2 Decomposed Wood Derivatives

Decomposed wood derivatives shall be ground bark, sawdust, yard trimmings, or other wood waste material that is free of stones, sticks, soil, and toxic substances harmful to plants, and is fully composted or stabilized with nitrogen.

## 2.4 MULCH

Mulch shall be free from weeds, mold, and other deleterious materials. Mulch materials shall be native to the region.

#### 2.4.1 Wood Cellulose Fiber

Wood cellulose fiber shall not contain any growth or germination-inhibiting factors and shall be dyed an appropriate color to facilitate placement during application. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 4.5 to 6.0.

#### 2.5 WATER

Water shall be the responsibility of the Contractor, unless otherwise noted. Water shall not contain elements toxic to plant life.

#### 2.6 PESTICIDE

Pesticide shall be insecticide, herbicide, fungicide, nematocide, rodenticide or miticide. For the purpose of this specification, a soil fumigant shall have the same requirements as a pesticide. The pesticide material shall be EPA registered and approved.

#### 2.7 SURFACE EROSION CONTROL MATERIAL

Surface erosion control material shall conform to the following:

##### 2.7.1 Erosion Control Blanket

Shall be machine produced mat of knitted straw, blanket-like mat construction, covered with degradable plastic mesh or interwoven degradable thread or plastic netting.

##### 2.7.2 Hydrophilic Colloids

Hydrophilic colloids shall be physiologically harmless to plant and animal life without phytotoxic agents. Colloids shall be naturally occurring, silicate powder based, and shall form a water insoluble membrane after curing. Colloids shall resist mold growth.

##### 2.7.3 Erosion Control Blanket Anchors

Erosion control anchors shall be as recommended by the manufacturer.

### PART 3 EXECUTION

#### 3.1 INSTALLING SEED TIME AND CONDITIONS

##### 3.1.1 Seeding Time

Seed shall be installed from March 15 to June 1 for spring establishment; and from August 15 to September 30 for fall establishment.

##### 3.1.2 Seeding Conditions

Seeding operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture, or other unsatisfactory conditions prevail, the work shall be stopped when directed.

When special conditions warrant a variance to the seeding operations, proposed alternate times shall be submitted for approval.

##### 3.1.3 Equipment Calibration

Immediately prior to the commencement of seeding operations, calibration tests shall be conducted on the equipment to be used. These tests shall confirm that the equipment is operating within the manufacturer's specifications and will meet the specified criteria. The equipment shall be calibrated a minimum of once every day during the operation. The calibration test results shall be provided within 1 week of testing.

### 3.2 SITE PREPARATION

#### 3.2.1 Finished Grade and Topsoil

The Contractor shall verify that finished grades are as indicated on drawings, and the placing of topsoil, smooth grading, and compaction requirements have been completed in accordance with Section 02300a EARTHWORK, prior to the commencement of the seeding operation.

#### 3.2.2 Application of Soil Amendments

##### 3.2.2.1 Applying Fertilizer

Fertilizer shall be applied at the rate of 200 pounds per acre. Fertilizer shall be incorporated into the soil to a maximum 4 inch.

#### 3.2.3 Tillage

Prior to seeding and installation of any utilities including electrical lines and irrigation lines the seeded areas shall be scarified with tractor pulled steel shanks to a depth of 350mm producing clods of dirt no larger than 75mm in size, then tilled to a minimum depth of 200 mm with tractor pulled rotary tillers to produce a smooth medium textured soil prior to beginning of sodding operations. Prior to rototilling organic material shall be spread in the amount of 5 cubic meters per 100 square meters. Organic material shall be rototilled into the scarified soil. Drainage patterns shall be maintained as indicated on drawings. Areas compacted by construction operations shall be completely pulverized by tillage. Soil used for repair of surface erosion or grade deficiencies shall conform to topsoil requirements. The fertilizer may be applied during this procedure. Soil on slopes up

#### 3.2.4 Prepared Surface

##### 3.2.4.1 Preparation

The prepared surface shall be a maximum 1 inch below the adjoining grade of any surfaced area. New surfaces shall be blended to existing areas. The prepared surface shall be completed with a light raking to remove debris.

##### 3.2.4.2 Debris

Debris and stones over a minimum 3 inch in any dimension shall be removed from the surface.

##### 3.2.4.3 Protection

Areas with the prepared surface shall be protected from compaction or damage by vehicular or pedestrian traffic and surface erosion.

### 3.3 INSTALLATION

Prior to installing seed, any previously prepared surface compacted or damaged shall be reworked to meet the requirements of paragraph SITE PREPARATION. Seeding operations shall not take place when the wind velocity will prevent uniform seed distribution.

#### 3.3.1 Installing Seed

Seeding procedure shall ensure even coverage. Gravity feed applicators, which drop seed directly from a hopper onto the prepared soil, shall not be used because of the difficulty in achieving even coverage, unless otherwise approved.

##### 3.3.1.1 Broadcast Seeding

Broadcast seeding shall be used when drill seeding is not possible because of tight spaces or steep slopes. Seed shall be uniformly broadcast at twice the recommended rate using broadcast seeders. Half the total rate of seed application shall be broadcast in one direction, with the remainder of the seed rate broadcast at 90 degrees from the first direction. Seed shall be covered a maximum 1/4 inch depth steel mat drag, hand raking, or other approved device.

##### 3.3.1.2 Drill Seeding

Seed shall be uniformly drilled to a maximum 1/2 inch depth and at the recommended rate using Brillon type equipment 6 inches. Row markers shall be used with the drill seeder. Half the total rate of seed application shall be drilled in one direction, with the remainder of the seed rate drilled at 90 degrees from the first direction. The drilling equipment shall be maintained with minimum half full seed boxes during the seeding operations.

##### 3.3.1.3 Rolling

The entire area shall be firmed with a roller not exceeding 90 pounds per foot roller width. Slopes over a maximum 3-horizontal-to-1 vertical shall not be rolled. Areas seeded with seed drills equipped with rollers shall not be rolled.

#### 3.3.2 Mulching

##### 3.3.2.1 Tackifier

Hydrophilic colloid shall be applied at the rate recommended by the manufacturer, using hydraulic equipment suitable for thoroughly mixing with water. A uniform mixture shall be applied over the area.

##### 3.3.2.2 Wood Cellulose Fiber

Wood cellulose fiber, shall be applied by itself with tackifier. The hydromulch shall be mixed and applied in accordance with the manufacturer's recommendations.

### 3.4 SURFACE EROSION CONTROL

#### 3.4.1 Erosion Control Blankets

Shall be installed where indicated on the drawings and around all inlets and outlets of storm drains adjacent to seeded areas. Erosion control blankets shall be installed in accordance with manufacturer's instructions.

Placement of the material shall be accomplished without damage to installed material or without deviation to finished grade.

### 3.4.2 Temporary Seeding

When directed during contract delays affecting the seeding operation or when a quick cover is required to prevent surface erosion, the areas designated shall be seeded in accordance with temporary seed species listed under Paragraph SEED.

#### 3.4.2.1 Soil Amendments

When soil amendments have not been applied to the area, the quantity of 1/2 of the required soil amendments shall be applied and the area tilled in accordance with paragraph SITE PREPARATION.

#### 3.4.2.2 Remaining Soil Amendments

The remaining soil amendments shall be applied in accordance with the paragraph Tillage when the surface is prepared for installing seed.

### 3.5 QUANTITY CHECK

For materials provided in bags, the empty bags shall be retained for recording the amount used. For materials provided in bulk, the weight certificates shall be retained as a record of the amount used. The amount of material used shall be compared with the total area covered to determine the rate of application used. Differences between the quantity applied and the quantity specified shall be adjusted as directed.

### 3.6 APPLICATION OF PESTICIDE

When application of a pesticide becomes necessary to remove a pest or disease, a pesticide treatment plan shall be submitted and coordinated with the installation pest management program.

#### 3.6.1 Technical Representative

The certified installation pest management coordinator shall be the technical representative, and shall be present at all meetings concerning treatment measures for pest or disease control. They may be present during treatment application.

#### 3.6.2 Application

A state certified applicator shall apply required pesticides in accordance with EPA label restrictions and recommendations. Clothing and personal protective equipment shall be used as specified on the pesticide label. A closed system is recommended as it prevents the pesticide from coming into contact with the applicator or other persons. Water for formulating shall only come from designated locations. Filling hoses shall be fitted with a backflow preventer meeting local plumbing codes or standards. Overflow shall be prevented during the filling operation. Prior to each day of use, the equipment used for applying pesticide shall be inspected for leaks, clogging, wear, or damage. Any repairs are to be performed immediately. A pesticide plan shall be submitted.

### 3.7 RESTORATION AND CLEAN UP

#### 3.7.1 Restoration

Existing turf areas, pavements, and facilities that have been damaged from the seeding operation shall be restored to original condition at Contractor's expense.

#### 3.7.2 Clean Up

Excess and waste material shall be removed from the seeded areas and shall be disposed offsite. Adjacent paved areas shall be cleaned.

### 3.8 PROTECTION OF INSTALLED AREAS

Immediately upon completion of the seeding operation in an area, the area shall be protected against foot or vehicle traffic or other use by erecting barricades and providing signage as required, or as directed.

### 3.9 SEED ESTABLISHMENT PERIOD

#### 3.9.1 Commencement

The seed establishment period to obtain a healthy stand of grass plants shall begin on the first day of work under this contract and shall end 3 months after the last day of the seeding operation. Written calendar time period shall be furnished for the seed establishment period. When there is more than 1 seed establishment period, the boundaries of the seeded area covered for each period shall be described. The seed establishment period shall be modified for inclement weather, shut down periods, or for separate completion dates of areas.

#### 3.9.2 Satisfactory Stand of Grass Plants

Grass plants shall be evaluated for species and health when the grass plants are a minimum 4 inches high. A satisfactory stand of grass plants from the seeding operation shall be a minimum 40 grass plants per square foot. The total bare spots shall not exceed 5 percent of the total seeded area.

#### 3.9.3 Maintenance During Establishment Period

Maintenance of the seeded areas shall include eradicating weeds, insects and diseases; protecting embankments and ditches from surface erosion; maintaining erosion control materials and mulch; protecting installed areas from traffic; mowing, and watering. Contractor shall minimize foot traffic onto the grass after seeding has been completed.

##### 3.9.3.1 Mowing

Seeded areas shall be mowed to a 75 mm 6 inch height whenever the grass reaches a height of 100mm. Mowing to remove weeds or undesirable species shall be performed whenever the height of the species reach a maximum of 100mm. Clippings shall be removed when the amount cut prevents sunlight from reaching the ground surface.

##### 3.9.3.2 Pesticide Treatment

Treatment for disease or pest shall be in accordance with paragraph APPLICATION OF PESTICIDE.

3.9.3.3 Repair or Reinstall

Unsatisfactory stands of grass plants and mulch shall be repaired or reinstalled, and eroded areas shall be repaired in accordance with paragraph SITE PREPARATION.

3.9.3.4 Watering

Contractor shall water the seeded grass with a temporary irrigation system for 90 days after the grass has been seeded. Contractor shall water the seeded grass with the equivalent of 10mm of water every day for the first two weeks. Thereafter the contractor shall water the seeded grass three times per week until the 90 days is up with the equivalent of 20mm of water.

3.9.3.5 Maintenance Record

A record of each site visit shall be furnished, describing the maintenance work performed; areas repaired or reinstalled; and diagnosis for unsatisfactory stand of grass plants.

-- End of Section --

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## SECTION 02930A

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**08/01**

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## SECTION 02930A

EXTERIOR PLANTING  
08/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN NURSERY AND LANDSCAPE ASSOCIATION (ANLA)

ANLA Z60.1 (1996) Nursery Stock

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A300 (1995) Tree Care Operations - Trees,  
Shrubs and other Woody Plant Maintenance

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 5268 (1992; R 1996) Topsoil Used for  
Landscaping Purposes

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-03 Product Data

Chemical Treatment Material;

Manufacturer's literature including physical characteristics, application and installation instructions.

Equipment;

A listing of equipment to be used for the planting operation.

Delivery;

Delivery schedule.

Plant Establishment Period; G-A0

Calendar time period for the plant establishment period. When there is more than one establishment period, the boundaries of the planted areas covered for each period shall be described.

## Maintenance Record;

Maintenance work performed, quantity of plant losses, and replacements; and diagnosis of unhealthy plant material.

## Application of Pesticide;

Pesticide treatment plan with sequence of treatment work with dates and times. The pesticide trade name, EPA registration number, chemical composition, formulation, concentration of original and diluted material, application rate of active ingredients, method of application, area treated, amount applied; and the name and state license number of the state certified applicator shall be included.

## SD-04 Samples

## Delivered Topsoil;

Samples taken from several locations at the source.

## Soil Amendments;

A 10 pound sample.

## Mulch; G-AO

A 10 pound sample.

## Decorative Boulders;

A Typical boulder of each size sample.

## SD-06 Test Reports

## Percolation Test;

Certified reports of inspections and laboratory tests, prepared by an independent testing agency, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.

## SD-07 Certificates

Plant Material;  
Topsoil;  
Fertilizer;  
Organic Material;  
Organic Mulch;  
Mycorrhizal Fungi Inoculum;  
Pesticide;

Prior to delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include the following.

- a. Plant Material: Classification, botanical name, common

name, size, quantity by species, and location where grown.

b. Topsoil: Particle size, organic matter content, textural class, soluble salts, chemical and mechanical analyses.

c. Fertilizer: Chemical analysis and composition percent.

d. Organic Material: Composition and source.

e. Organic Mulch: Composition, source, and treatment against fungi growth.

f. Mycorrhizal Fungi Inoculum: Plant material treated.

g. Pesticide. EPA registration number and registered uses.

#### SD-10 Operation and Maintenance Data

##### Maintenance Instructions;

Instruction for year-round care of installed plant material.

### 1.3 SOURCE INSPECTIONS

The nursery or source of plant material and the source of delivered topsoil shall be subject to inspection.

### 1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING

#### 1.4.1 Delivery

A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery.

##### 1.4.1.1 Plant Material Identification

Plant material shall be identified with attached, durable, waterproof labels and weather-resistant ink, stating the correct botanical plant name and size.

##### 1.4.1.2 Protection During Delivery

Plant material shall be protected during delivery to prevent desiccation and damage to the branches, trunk, root system, or earth ball. Branches shall be protected by tying-in. Exposed branches shall be covered during transport.

##### 1.4.1.3 Delivered Topsoil

Prior to the delivery of any topsoil, the availability of topsoil shall be verified in paragraph TOPSOIL.

##### 1.4.1.4 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

#### 1.4.1.5 Pesticide Material

Pesticide material shall be delivered to the site in the original, unopened containers bearing legible labels indicating the Environmental Protection Agency (EPA) registration number and the manufacturer's registered uses.

#### 1.4.2 Inspection

Plant material shall be well shaped, vigorous and healthy with a healthy, well branched root system, free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement or abrasion. Plant material shall be checked for unauthorized substitution and to establish nursery grown status. Plant material showing desiccation, abrasion, sun-scald injury, disfigurement, or unauthorized substitution shall be rejected. The plant material shall exhibit typical form of branch to height ratio; and meet the caliper and height measurements specified. Plant material that measures less than specified, or has been poled, topped off or headed back, shall be rejected. Container-grown plant material shall show new fibrous roots and the root mass shall contain its shape when removed from the container. Plant material with broken or cracked balls; or broken containers shall be rejected. Other materials shall be inspected for compliance with paragraph PRODUCTS. Open soil amendment containers or wet soil amendments shall be rejected. Topsoil that contains slag, cinders, stones, lumps of soil, sticks, roots, trash or other material larger than 1-1/2 inch diameter shall be rejected. Topsoil that contains viable plant material and plant parts shall be rejected. Unacceptable material shall be removed from the job site.

#### 1.4.3 Storage

##### 1.4.3.1 Plant Material Storage

Plant material not installed on the day of arrival at the site shall be stored and protected in designated areas. Plant material shall not be stored longer than 30 days. Plant material shall be protected from direct exposure to wind and sun. All plant material shall be kept in a moist condition by watering with a fine mist spray until installed.

##### 1.4.3.2 Other Material Storage

Storage of other material shall be in designated areas. Soil amendments shall be stored in dry locations and away from contaminants. Chemical treatment material shall be stored according to manufacturer's instructions and not with planting operation material.

#### 1.4.4 Handling

Plant material shall not be injured in handling. Cracking or breaking the earth ball of balled and burlapped plant material shall be avoided. Plant material shall not be handled by the trunk or stems. Materials shall not be dropped from vehicles.

#### 1.4.5 Time Limitation

Except for container-grown plant material, the time limitation from digging to installing plant material shall be a maximum 90 days. The time limitation between installing the plant material and placing the mulch shall be a maximum 24 hours.

## 1.5 WARRANTY

Furnished plant material shall have a warranty for plant growth to be in a vigorous growing condition for a minimum 12 month period. A minimum 12 month calendar time period for the warranty of plant growth shall be provided regardless of the contract time period. When plant material is determined to be unhealthy in accordance with paragraph PLANT ESTABLISHMENT PERIOD, it shall be replaced once under this warranty.

## PART 2 PRODUCTS

### 2.1 PLANT MATERIAL

#### 2.1.1 Plant Material Classification

The plant material shall be nursery grown stock conforming to ANLA Z60.1 and shall be the species specified.

#### 2.1.2 Plant Schedule

The plant schedule shall provide botanical names as included in one or more of the publications listed under "Nomenclature" in ANLA Z60.1.

#### 2.1.3 Substitutions

Substitutions will not be permitted without written request and approval from the Contracting Officer.

#### 2.1.4 Quality

Well shaped, well grown, vigorous plant material having healthy and well branched root systems in accordance with ANLA Z60.1 shall be provided. Plant material shall be provided free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement and abrasion. Plant material shall be free of shock or damage to branches, trunk, or root systems, which may occur from the digging and preparation for shipment, method of shipment, or shipment. Plant quality is determined by the growing conditions; method of shipment to maintain health of the root system; and growth of the trunk and crown as follows.

#### 2.1.5 Growing Conditions

Plant material shall be native to or well-suited to the growing conditions of the project site. Plant material shall be grown under climatic conditions similar to those at the project site.

#### 2.1.6 Method of Shipment to Maintain Health of Root System

##### 2.1.6.1 Balled and Burlapped (BB) Plant Material

Ball size and ratio shall be in accordance with ANLA Z60.1. The ball shall be of a diameter and depth to encompass enough fibrous and feeding root system necessary for the full recovery of the plant. The plant stem or trunk shall be centered in the ball. All roots shall be clean cut at the ball surface. Roots shall not be pulled from the ground. Before shipment the root ball shall be dipped in gels containing mycorrhizal fungi inoculum. The root ball shall be completely wrapped with burlap or other suitable material and securely laced with biodegradable twine.

#### 2.1.6.2 Balled and Potted (Pot) Plant Material

Ball size and ratio shall be in accordance with ANLA Z60.1. The ball shall be of a diameter and depth to encompass enough fibrous and feeding root system necessary for the full recovery of the plant. Removal shall be done by hand digging or mechanical devices. The plant stem or trunk shall be centered in the ball. All roots shall be clean cut at the ball surface. Roots shall not be pulled from the ground. Before shipment the root ball shall be dipped in gels containing mycorrhizal fungi inoculum. Container shall be used to retain the ball unbroken. Container shall be rigid to hold ball shape and protect root mass during shipping.

#### 2.1.6.3 Container-Grown (C) Plant Material

Container size shall be in accordance with ANLA Z60.1. Plant material shall be grown in a container over a duration of time for new fibrous roots to have developed and for the root mass to retain its shape and hold together when removed from the container. Container-grown plant material shall be inoculated with mycorrhizal fungi during germination in the nursery. Before shipment the root system shall be dipped in gels containing mycorrhizal fungi inoculum. The container shall be sufficiently rigid to hold ball shape and protect root mass during shipping.

#### 2.1.7 Growth of Trunk and Crown

##### 2.1.7.1 Deciduous Trees

A height to caliper relationship shall be provided in accordance with ANLA Z60.1. Height of branching shall bear a relationship to the size and species of tree specified and with the crown in good balance with the trunk. The trees shall not be "poled" or the leader removed.

- a. Single stem: The trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader.
- b. Multi-stem: All countable stems, in aggregate, shall average the size specified. To be considered a stem, there shall be no division of the trunk which branches more than 6 inches from ground level.

##### 2.1.7.2 Deciduous Shrubs

Deciduous shrubs shall have the height and number of primary stems recommended by ANLA Z60.1. Acceptable plant material shall be well shaped, with sufficient well-spaced side branches, and recognized by the trade as typical for the species grown in the region of the project.

##### 2.1.7.3 Coniferous Evergreen Plant Material

Coniferous Evergreen plant material shall have the height-to-spread ratio recommended by ANLA Z60.1. The coniferous evergreen trees shall not be "poled" or the leader removed. Acceptable plant material shall be exceptionally heavy, well shaped and trimmed to form a symmetrical and tightly knit plant. The form of growth desired shall be as indicated.

##### 2.1.7.4 Ground Cover and Vine Plant Material

Ground cover and vine plant material shall have the minimum number of runners and length of runner recommended by ANLA Z60.1. Plant material

shall have heavy, well developed and balanced crown with vigorous, well developed root system and shall be furnished in containers.

#### 2.1.8 Plant Material Size

Plant material shall be furnished in sizes indicated. Plant material larger in size than specified may be provided at no additional cost to the Government.

#### 2.1.9 Plant Material Measurement

Plant material measurements shall be in accordance with ANLA Z60.1.

### 2.2 TOPSOIL

Topsoil shall be as defined in ASTM D 5268. When available, the topsoil shall be the existing surface soil stripped and stockpiled onsite in accordance with Section 02300a EARTHWORK. When additional topsoil is required topsoil shall be delivered from areas that regularly produce agricultural products and shall be free from slag, cinders, stones larger than 15mm, lumps of soil, sticks, roots, trash or other material over a minimum 1-1/2 inch diameter. Topsoil shall be free from viable plants and plant parts. The pH range shall be 6.0 to 7.5. Topsoil that does not meet this pH range shall be amended by the addition of pH adjusters

### 2.3 SOIL AMENDMENTS

Soil amendments shall consist of fertilizer, organic material meeting the following requirements. Vermiculite is not recommended.

#### 2.3.1 Fertilizer

Fertilizer shall be controlled release commercial grade; free flowing, pellet or tablet form; uniform in composition; and consist of a nitrogen-phosphorus-potassium ratio. The fertilizer shall be derived from sulphur coated urea, urea formaldehyde, plastic or polymer coated pills, or isobutylenediurea (IBDU). Fertilizer shall be balanced with the inclusion of trace minerals and micro-nutrients.

#### 2.3.2 Organic Material

Organic material shall consist of either peat, rotted manure, decomposed wood derivatives.

##### 2.3.2.1 Rotted Manure

Rotted manure shall be cattle manure containing a maximum 25 percent by volume of straw, sawdust, or other bedding materials. Manure shall contain no chemicals or ingredients harmful to plants. The manure shall be heat treated to kill weed seeds and shall be free of stones, sticks, and soil.

##### 2.3.2.2 Decomposed Wood Derivatives

Decomposed wood derivatives shall be ground bark, sawdust, or other wood waste material free of stones, sticks, and toxic substances harmful to plants, and stabilized with nitrogen.

### 2.4 MULCH

Mulch shall be free from weeds, mold, and other deleterious materials. Mulch materials shall be native to the region. Rotted manure is not recommended to be used as a mulch because it would encourage surface rooting of the plant material and weeds.

#### 2.4.1 Inorganic Mulch

When inorganic mulch is required for decorative purposes, it shall be provided in areas designated, and consist of 1 inch to 1-1/2 inches washed river gravel, in the color range of medium brown

#### 2.4.2 Organic Mulch

Organic mulch materials shall consist dark brown shredded cedar bark commercially produced.

### 2.5 WOOD STAKING MATERIAL

Wood stakes shall be hardwood or fir; rough sawn; free from knots, rot, cross grain, or other defects that would impair their strength.

#### 2.5.1 Bracing Stake

Wood bracing stakes shall be a minimum 2 x 2 inch square and a minimum 8 feet long with a point at one end. Stake shall be set without damaging rootball.

#### 2.5.2 Wood Ground Stakes

Wood ground stakes shall be a minimum of 2 x 2 inch square and a minimum 3 feet long with a point at one end.

#### 2.5.3 Deadmen

Wood deadmen shall be a minimum 4 x 4 x 36 inches long.

### 2.6 METAL STAKING AND GUYING MATERIAL

Metal shall be aluminum or steel consisting of recycled content made for holding plant material in place.

#### 2.6.1 Bracing Stakes

Metal bracing stakes shall be a minimum 1 inch diameter and a minimum 8 feet long. Stake shall be set without damaging rootball.

#### 2.6.2 Metal Ground Stakes

Metal ground stakes shall be a minimum 1/2 inch diameter and a minimum 3 feet long.

#### 2.6.3 Earth Anchor

Metal earth anchors shall be a minimum 1/2 inch diameter and a minimum 2 feet long.

#### 2.6.4 Guying Material

Metal guying material shall be a minimum 12 gauge wire. Multi-strand cable

shall be woven wire. Guying material tensile strength shall conform to the size of tree to be held firmly in place.

#### 2.6.5 Turnbuckle

Metal turnbuckles shall be galvanized or cadmium-plated steel, and shall be a minimum 3 inches long with closed screw eyes on each end. Screw thread tensile strength shall conform to the size of tree to be held firmly in place.

#### 2.7 PLASTIC STAKING AND GUYING MATERIAL

Plastic shall consist of recycled plastic product made for holding plant material firmly in place. Plastic shall not be used for deadmen.

##### 2.7.1 Plastic Guying Material

Plastic guying material shall be designed specifically for the purpose of firmly holding plant material in high wind velocities.

##### 2.7.2 Chafing Guard

Plastic chafing guards shall be used to protect tree trunks and branches when metal is used as guying material. The material shall be the same color throughout the project site. Length shall be a minimum 1.5 times the circumference of the plant trunk at its base.

#### 2.8 RUBBER GUYING MATERIAL

Rubber chafing guards, consisting of recycled material, shall be used to protect tree trunks and branches when metal guying material is applied. The material shall be the same color throughout the project. Length shall be a minimum 1.5 times the circumference of the plant trunk at its base.

#### 2.9 FLAG

Plastic flag material shall be used on guying material. It shall be a minimum 6 inches long. Tape color shall be consistent and visually complimentary to the entire project area. The tape color shall meet pedestrian visual safety requirements for day and night.

#### 2.10 MYCORRHIZAL FUNGI INOCULUM

Mycorrhizal fungi inoculum shall be composed of multiple-fungus inoculum as recommended by the manufacturer for the plant material specified.

#### 2.11 WATER

Unless otherwise directed, water shall be the responsibility of the Contractor. Water shall not contain elements toxic to plant life.

#### 2.12 PESTICIDE

Pesticide shall be insecticide, herbicide, fungicide, nematocide, rodenticide or miticide. For the purpose of this specification a soil fumigant shall have the same requirements as a pesticide. The pesticide material shall be EPA registered and approved.

#### 2.13 TREE WRAP

Tree wrap shall be two thicknesses of crinkled paper cemented together with a layer of bituminous material. Wrapping material shall be a minimum of 4 inches in width and have a stretch factor of 33-1/3 percent. Twine for tying shall be lightly tarred medium or coarse sisal yarn.

#### 2.14 Decorative Boulders

Decorative Boulders shall be rock material representative of the area in which the facility is built. Sizes of material shall vary from a minimum of 1' (12") to 3' (36") in diameter, or equivalent mass. The chosen boulders shall be those that are typically used for landscape purposes in the area. Boulders shall complement the building color. See Landscape Plan for proportional quantity of each size of boulder and total quantity.

### PART 3 EXECUTION

#### 3.1 INSTALLING PLANT MATERIAL TIME AND CONDITIONS

##### 3.1.1 Deciduous Plant Material Time

Deciduous plant material shall be installed from April 1 to June 1 for spring planting and October 1 to November 15 for fall planting.

##### 3.1.2 Evergreen Plant Material Time

Evergreen plant material shall be installed from April 1 to June 1 for spring planting and September 1 to October 1 for fall planting.

##### 3.1.3 Plant Material Conditions

Planting operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture, frozen ground or other unsatisfactory conditions prevail, the work shall be stopped when directed. When special conditions warrant a variance to the planting operations, proposed planting times shall be submitted for approval.

##### 3.1.4 Tests

###### 3.1.4.1 Percolation Test

Test for percolation shall be done to determine positive drainage of plant pits and beds. A positive percolation shall consist of a minimum 1 inch per 3 hours; when a negative percolation test occurs, a shop drawing shall be submitted indicating the corrective measures.

#### 3.2 SITE PREPARATION

##### 3.2.1 Finished Grade, Topsoil and Underground Utilities

The Contractor shall verify that finished grades are as indicated on drawings, and that the placing of topsoil, the smooth grading, and the compaction requirements have been completed prior to the commencement of the planting operation. The location of underground utilities and facilities in the area of the planting operation shall be verified. Damage to underground utilities and facilities shall be repaired at the Contractor's expense.

##### 3.2.2 Layout

Plant material locations and bed outlines shall be staked on the project site before any excavation is made. Plant material locations may be adjusted to meet field conditions.

### 3.2.3 Protecting Existing Vegetation

When there are established lawns in the planting area, the turf shall be covered and/or protected during planting operations. Existing trees, shrubs, and plant beds that are to be preserved shall be barricaded along the dripline to protect them during planting operations.

## 3.3 EXCAVATION

### 3.3.1 Obstructions Below Ground

When obstructions below ground affect the work, shop drawings showing proposed adjustments to plant material location, type of plant and planting method shall be submitted for approval.

### 3.3.2 Tree Plant Bed Preparation

Planting beds for trees are defined as all areas indicated on the plans bordered by concrete edging, walks, or curbs indicated to have organic or inorganic mulch where trees and shrubs are planted. Planting beds for trees shall be scarified with tractor pulled steel shanks to a depth of 350mm producing clods of dirt no larger than 75mm in size, then tilled to a minimum depth of 200 mm with tractor pulled rotary tillers to produce a smooth medium textured soil prior to beginning of planting operations. Prior to rototilling organic material shall be spread in the amount of 5 cubic meters per 100 square meters. Organic material shall be rototilled into the scarified soil.

### 3.3.3 Shrub Plant Bed Preparation

Planting beds for shrubs are those areas inside Tree Planting beds where shrubs, ornamental grasses and groundcovers are planted. Planting beds for shrubs, ornamental grasses, and groundcovers shall have the soil scarified to a depth of 350mm producing clods of dirt no larger than 75mm in size then have the top 200mm of soil removed and replaced with topsoil. Organic material in the amount of 6 cubic meters per 100 square meters shall be spread on top of the topsoil layer then rototilled into the soil producing a fine textured soil.

### 3.3.4 Plant Pits

Plant pits for ball and burlapped or container plant material shall be dug to a depth equal to the height of the root ball as measured from the base of the ball to the base of the plant trunk. Plant pits shall be dug a minimum 50 percent wider than the ball or root system to allow for root expansion. The pit shall be constructed with sides sloping towards the base as a cone, to encourage well aerated soil to be available to the root system for favorable root growth. Cylindrical pits with vertical sides shall not be used.

## 3.4 INSTALLATION

### 3.4.1 Setting Plant Material

Plant material shall be set plumb and held in position until sufficient soil has been firmly placed around root system or ball. In relation to the surrounding grade, the plant material shall be set even with the grade at which it was grown.

#### 3.4.2 Tree Root Barrier

Tree root barriers shall be installed as recommended by the manufacturer. Tree root barriers shall be used for trees located up to a maximum 6 feet from paved surfaces or structures.

#### 3.4.3 Backfill Soil Mixture

The backfill soil mixture shall be a mixture of 1/3 topsoil and 2/3 excavated soil from the plant pit and soil amendments suitable for the plant material specified.

#### 3.4.4 Adding Mycorrhizal Fungi Inoculum

Mycorrhizal fungi inoculum shall be added as recommended by the manufacturer for all the plant material specified.

#### 3.4.5 Backfill Procedure

Prior to backfilling, all metal, wood, synthetic products, or treated burlap devices shall be removed from the ball or root system avoiding damage to the root system. The backfill procedure shall remove air pockets from around the root system. Additional requirements are as follows.

##### 3.4.5.1 Balled and Burlapped, and Balled and Platformed Plant Material

Biodegradable burlap and tying material shall be carefully opened and folded back from the top a minimum 1/3 depth from the top of the root ball. Backfill mixture shall be added to the plant pit in 6 inch layers with each layer tamped.

##### 3.4.5.2 Container-Grown and Balled and Potted Plant Material

The plant material shall be carefully removed from containers that are not biodegradable. Prior to setting the plant in the pit, a maximum 1/4 depth of the root mass, measured from the bottom, shall be spread apart to promote new root growth. For plant material in biodegradable containers the container shall be split prior to setting the plant with container. Backfill mixture shall be added to the plant pit in 6 inch layers with each layer tamped.

##### 3.4.5.3 Earth Berm

An earth berm, consisting of backfill soil mixture, shall be formed with a minimum , 3 inch height around the edge of the plant pit to aid in water retention and to provide soil for settling adjustments.

#### 3.4.6 Plant Bed

Plant material shall be set in plant beds according to the drawings. Backfill soil mixture shall completely surround the root balls, and shall be brought to a smooth and even surface, blending to existing areas. Earth berms shall be provided. Polymers shall be spread uniformly over the plant bed and in the planting pit as recommended by the manufacturer and

thoroughly incorporated into the soil to a maximum 4 inch depth.

#### 3.4.7 Watering

Plant pits and plant beds shall be watered immediately after backfilling, until completely saturated.

#### 3.4.8 Staking and Guying

Staking will be required when trees are unstable or will not remain set due to their size, shape, or exposure to high wind velocity.

##### 3.4.8.1 One Bracing Stake

Trees 4 to 6 feet high shall be firmly anchored in place with one bracing stake. The bracing stake shall be placed on the side of the tree facing the prevailing wind. The bracing stake shall be driven vertically into firm ground and shall not injure the ball or root system. The tree shall be held firmly to the stake with a double strand of guying material. The guying material shall be firmly anchored at a minimum 1/2 tree height and shall prevent girdling. A chafing guard shall be used when metal is the guying material.

##### 3.4.8.2 Two Bracing Stakes

Trees from 6 to 8 feet height shall be firmly anchored in place with 2 bracing stakes placed on opposite sides. Bracing stakes shall be driven vertically into firm ground and shall not injure the ball or root system. The tree shall be held firmly between the stakes with a double strand of guying material. The guying material shall be firmly anchored at a minimum 1/2 tree height and shall prevent girdling. Chafing guards shall be used when metal is the guying material.

##### 3.4.8.3 Three Ground Stakes

Trees over a minimum 8 feet height and less than a maximum 6 inch caliper shall be held firmly in place with 3 bracing or ground stakes spaced equidistantly around the tree. Ground stakes shall be avoided in areas to be mowed. Stakes shall be driven into firm ground outside the earth berm. The guying material shall be firmly anchored at a minimum 1/2 tree height and shall prevent girdling. For trees over maximum 3 inch diameter at breast height, turnbuckles shall be used on the guying material for tree straightening purposes. One turnbuckle shall be centered on each guy line. Chafing guards shall be used when metal is the guying material.

#### 3.4.9 Deadmen or Earth Anchors

Trees over a minimum 6 inch caliper shall be held firmly in place with wood deadmen buried a minimum 3 feet in the ground or metal earth anchors.

Multi-strand cable guying material shall be firmly anchored at a minimum 1/2 tree height and shall prevent girdling. Turnbuckles shall be used on the guying material for tree straightening purposes. One turnbuckle shall be centered on each guy line. Chafing guards shall be used.

#### 3.4.10 Flags

A flag shall be securely fastened to each guy line equidistant between the tree and the stake, deadmen, or earth anchor. The flag shall be visible to pedestrians.

### 3.4.11 Tree Wrapping

The trunks of deciduous trees shall be wrapped within 24 hours after planting. The trunks of the trees shall be inspected for physical damage or insect infestation and required treatment or rejection prior to the wrapping operation shall be determined. The trunks of deciduous trees, 1-1/2 inch or greater in caliper, shall be wrapped with the specified material beginning at the base and extending to the first branches. The wrapping shall be securely tied at the top and bottom and at 2 foot maximum intervals with twine.

## 3.5 FINISHING

### 3.5.1 Edging Installation

Prior to placing mulch, the installed area shall be uniformly edged to provide a clear division line between the planted area and the adjacent turf area, shaped as indicated on the plans. Top of edging material shall be 25mm above the top the soil for turf areas and above grade areas to be seeded. The installed area shall be raked and smoothed while maintaining the earth berms. See plans for type and location of edging.

### 3.5.2 Placing Mulch

The placement of mulch shall occur a maximum 48 hours after planting. Mulch, used to reduce soil water loss, regulate soil temperature and prevent weed growth, shall be spread to cover the installed area with a minimum 4 inch uniform thickness. Mulch shall be kept out of the crowns of shrubs, ground cover, and vines and shall be kept off buildings, sidewalks and other facilities.

### 3.5.3 Landscape Boulders

See plans for layout of landscape boulders. Consult with Contracting Representative on final layout of Boulders. Boulders shall be placed on mulch bed prior to placing rock mulch and surrounded by the mulch after final placement.

### 3.5.4 Pruning

Pruning shall be accomplished by trained and experienced personnel. The pruning of trees shall be in accordance with ANSI A300. Only dead or broken material shall be pruned from installed plants. The typical growth habit of individual plant material shall be retained. Clean cuts shall be made flush with the parent trunk. Improper cuts, stubs, dead and broken branches shall be removed. "Headback" cuts at right angles to the line of growth will not be permitted. Trees shall not be poled or the leader removed, nor shall the leader be pruned or "topped off".

## 3.6 MAINTENANCE DURING PLANTING OPERATION

Installed plant material shall be maintained in a healthy growing condition. Maintenance operations shall begin immediately after each plant is installed to prevent desiccation and shall continue until the plant establishment period commences. Installed areas shall be kept free of weeds, grass, and other undesired vegetation. The maintenance includes maintaining the mulch, watering, and adjusting settling.

### 3.7 APPLICATION OF PESTICIDE

When application of a pesticide becomes necessary to remove a pest or disease, a pesticide treatment plan shall be submitted and coordinated with the installation pest management program.

#### 3.7.1 Technical Representative

The certified installation pest management coordinator shall be the technical representative, and shall be present at all meetings concerning treatment measures for pest or disease control. They may be present during treatment application.

#### 3.7.2 Application

A state certified applicator shall apply required pesticides in accordance with EPA label restrictions and recommendations. Clothing and personal protective equipment shall be used as specified on the pesticide label. A closed system is recommended as it prevents the pesticide from coming into contact with the applicator or other persons. Water for formulating shall only come from designated locations. Filling hoses shall be fitted with a backflow preventer meeting local plumbing codes or standards. Overflow shall be prevented during the filling operation. Prior to each day of use, the equipment used for applying pesticide shall be inspected for leaks, clogging, wear, or damage. Any repairs are to be performed immediately.

### 3.8 RESTORATION AND CLEAN UP

#### 3.8.1 Restoration

Turf areas, pavements and facilities that have been damaged from the planting operation shall be restored to original condition at the Contractor's expense.

#### 3.8.2 Clean Up

Excess and waste material shall be removed from the installed area and shall be disposed offsite. Adjacent paved areas shall be cleared.

### 3.9 PLANT ESTABLISHMENT PERIOD

#### 3.9.1 Commencement

Upon completion of the last day of the planting operation, the plant establishment period for maintaining installed plant material in a healthy growing condition shall commence and shall be in effect for a minimum of 90 days or the remaining contract time period, whichever is longer, not to exceed 12 months. Written calendar time period shall be furnished for the plant establishment period. When there is more than one plant establishment period, the boundaries of the planted area covered for each period shall be described. The plant establishment period shall be coordinated with Sections 02921a SEEDING; and 02922a SODDING. The plant establishment period shall be modified for inclement weather shut down periods, or for separate completion dates for areas.

#### 3.9.2 Maintenance During Establishment Period

Maintenance of plant material shall include straightening plant material, straightening stakes; tightening guying material; correcting girdling;

supplementing mulch; pruning dead or broken branch tips; maintaining plant material labels; watering; eradicating weeds, insects and disease; post-fertilization; and removing and replacing unhealthy plants.

#### 3.9.2.1 Watering Plant Material

The plant material shall be watered immediately after planting and as necessary to prevent desiccation and to maintain an optimal supply of moisture within the root zone. An optimal supply of moisture is estimated to be the equivalent of 2 inch absorbed water per week, delivered in the form of rain or augmented by watering. Run-off, puddling and wilting shall be prevented. Unless otherwise directed, watering trucks shall not be driven over turf areas. Watering of other adjacent areas or existing plant material shall be prevented.

#### 3.9.2.2 Weeding

Grass and weeds in the installed areas shall not be allowed to reach a maximum 3 inches height before being completely removed, including the root system.

#### 3.9.2.3 Pesticide Treatment

Treatment for disease or pest shall be in accordance with paragraph APPLICATION OF PESTICIDE.

#### 3.9.2.4 Post-Fertilization

The plant material shall be topdressed at least once during the period of establishment with controlled release fertilizer, reference paragraph SOIL AMENDMENTS. Apply at the rate of 2 pounds per 100 square feet of plant pit or bed area. Dry fertilizer adhering to plants shall be flushed off. The application shall be timed prior to the advent of winter dormancy.

#### 3.9.2.5 Plant Pit Settling

When settling occurs to the backfill soil mixture, additional backfill soil shall be added to the plant pit or plant bed until the backfill level is equal to the surrounding grade. Serious settling that affects the setting of the plant in relation to the maximum depth at which it was grown requires replanting in accordance with paragraph INSTALLATION. The earth berm shall be maintained.

#### 3.9.2.6 Maintenance Record

A record shall be furnished describing the maintenance work performed, the quantity of plant losses, diagnosis of the plant loss, and the quantity of replacements made on each site visit.

#### 3.9.3 Unhealthy Plant Material

A tree shall be considered unhealthy or dead when the main leader has died back, or up to a maximum 25 percent of the crown has died. A shrub shall be considered unhealthy or dead when up to a maximum 25 percent of the plant has died. This condition shall be determined by scraping on a branch an area 1/16 inch square, maximum, to determine if there is a green cambium layer below the bark. The Contractor shall determine the cause for unhealthy plant material and shall provide recommendations for replacement.

Unhealthy or dead plant material shall be removed immediately and shall be

replaced as soon as possible

#### 3.9.4 Replacement Plant Material

Unless otherwise directed, plant material shall be provided for replacement in accordance with paragraph PLANT MATERIAL. Replacement plant material shall be installed in accordance with paragraph INSTALLATION, and recommendations in paragraph PLANT ESTABLISHMENT PERIOD. Plant material shall be replaced in accordance with paragraph WARRANTY. An extended plant establishment period shall not be required for replacement plant material.

#### 3.9.5 Maintenance Instructions

Written instructions shall be furnished containing drawings and other necessary information for year-round care of the installed plant material; including, when and where maintenance should occur, and the procedures for plant material replacement.

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SECTION 03100A

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## SECTION 03100A

STRUCTURAL CONCRETE FORMWORK  
05/98

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## ACI INTERNATIONAL (ACI)

ACI 347R (1994) Guide to Formwork for Concrete

## U.S. DEPARTMENT OF COMMERCE (DOC)

PS-1 (1996) Voluntary Product Standard -  
Construction and Industrial Plywood

## 1.2 DESIGN

Formwork shall be designed in accordance with methodology of ACI 347R for anticipated loads, lateral pressures, and stresses. Forms shall be capable of producing a surface which meets the requirements of the class of finish specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Forms shall be capable of withstanding the pressures resulting from placement and vibration of concrete.

## PART 2 PRODUCTS

## 2.1 FORM MATERIALS

## 2.1.1 Forms For Class B Finish

Forms for Class B finished surfaces shall be plywood panels conforming to PS-1, Grade B-B concrete form panels, Class I or II. Other form materials or liners may be used provided the smoothness and appearance of concrete produced will be equivalent to that produced by the plywood concrete form panels.

## 2.1.2 Forms For Class D Finish

Forms for Class D finished surfaces, except where concrete is placed against earth, shall be wood or steel or other approved concrete form material.

## 2.1.3 Form Ties

Form ties shall be factory-fabricated metal ties, shall be of the removable or internal disconnecting or snap-off type, and shall be of a design that will not permit form deflection and will not spall concrete upon removal.

Solid backing shall be provided for each tie. Except where removable tie rods are used, ties shall not leave holes in the concrete surface less than 1/4 inch nor more than 1 inch deep and not more than 1 inch in diameter. Removable tie rods shall be not more than 1-1/2 inches in diameter.

#### 2.1.4 Form Releasing Agents

Form releasing agents shall be commercial formulations that will not bond with, stain or adversely affect concrete surfaces. Agents shall not impair subsequent treatment of concrete surfaces depending upon bond or adhesion nor impede the wetting of surfaces to be cured with water or curing compounds.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

##### 3.1.1 Formwork

Forms shall be mortar tight, properly aligned and adequately supported to produce concrete surfaces meeting the surface requirements specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE and conforming to construction tolerance given in TABLE 1. Where concrete surfaces are to have a Class A or Class B finish, joints in form panels shall be arranged as approved. Where forms for continuous surfaces are placed in successive units, the forms shall fit over the completed surface to obtain accurate alignment of the surface and to prevent leakage of mortar. Forms shall not be reused if there is any evidence of surface wear and tear or defects which would impair the quality of the surface. Surfaces of forms to be reused shall be cleaned of mortar from previous concreting and of all other foreign material before reuse. Form ties that are to be completely withdrawn shall be coated with a nonstaining bond breaker.

##### 3.2 CHAMFERING

Except as otherwise shown, external corners that will be exposed shall be chamfered, beveled, or rounded by moldings placed in the forms.

##### 3.3 COATING

Forms for Class B finished surfaces shall be coated with a form releasing agent before the form or reinforcement is placed in final position. The coating shall be used as recommended in the manufacturer's printed or written instructions. Forms for Class D finished surfaces may be wet with water in lieu of coating immediately before placing concrete, except that in cold weather with probable freezing temperatures, coating shall be mandatory. Surplus coating on form surfaces and coating on reinforcing steel and construction joints shall be removed before placing concrete.

##### 3.4 REMOVAL OF FORMS

Forms shall be removed preventing injury to the concrete and ensuring the complete safety of the structure. Formwork for columns, walls, side of beams and other parts not supporting the weight of concrete may be removed when the concrete has attained sufficient strength to resist damage from the removal operation but not before at least 24 hours has elapsed since concrete placement. Supporting forms and shores shall not be removed from beams, floors and walls until the structural units are strong enough to carry their own weight and any other construction or natural loads.

Supporting forms or shores shall not be removed before the concrete strength has reached 70 percent of design strength, as determined by field cured cylinders or other approved methods. This strength shall be demonstrated by job-cured test specimens, and by a structural analysis considering the proposed loads in relation to these test strengths and the strength of forming and shoring system. The job-cured test specimens for form removal purposes shall be provided in numbers as directed and shall be in addition to those required for concrete quality control. The specimens shall be removed from molds at the age of 24 hours and shall receive, insofar as possible, the same curing and protection as the structures they represent.

TABLE 1

TOLERANCES FOR FORMED SURFACES

1. Variations from the plumb:	In any 10 feet of length ----- 1/4 inch
a. In the lines and surfaces of columns, piers, walls and in arises	Maximum for entire length ----- 1 inch
b. For exposed corner columns, control-joint grooves, and other conspicuous lines	In any 20 feet of length ----- 1/4 inch Maximum for entire length----- 1/2 inch
2. Variation from the level or from the grades indicated on the drawings:	In any 10 feet of length -----1/4 inch In any bay or in any 20 feet of length----- 3/8 inch
a. In slab soffits, ceilings, beam soffits, and in arises, measured before removal of supporting shores	Maximum for entire length ----- 3/4 inch
b. In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines	In any bay or in any 20 feet of length ----- 1/4 inch Maximum for entire length----- 1/2 inch
3. Variation of the linear building lines from established position in plan	In any 20 feet ----- 1/2 inch Maximum -----1 inch
4. Variation of distance between walls, columns, partitions	1/4 inch per 10 feet of distance, but not more than 1/2 inch in any one bay, and not more than 1 inch total variation
5. Variation in the sizes and locations	Minus ----- 1/4 inch Plus ----- 1/2 inch

TABLE 1

TOLERANCES FOR FORMED SURFACES

of sleeves, floor openings, and wall opening		
6. Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls	Minus -----	1/4 inch
	Plus -----	1/2 inch
7. Footings:		
a. Variation of dimensions in plan	Minus -----	1/2 inch
	Plus -----	2 inches
		when formed or plus 3 inches when placed against unformed excavation
b. Misplacement of eccentricity		2 percent of the footing width in the direction of misplacement but not more than 2 inches
c. Reduction in thickness of specified thickness	Minus -----	5 percent
8. Variation in steps:	Riser -----	1/8 inch
a. In a flight of stairs	Tread -----	1/4 inch
b. In consecutive steps	Riser -----	1/16 inch
	Tread -----	1/8 inch
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## SECTION 03150A

EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS  
05/98

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4 (1995) Basic Hardboard

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 919 (1984; R 1998) Use of Sealants in Acoustical Applications

ASTM C 920 (1998) Elastomeric Joint Sealants

ASTM D 471 (1998e1) Rubber Property - Effect of Liquids

ASTM D 1751 (1999) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

ASTM D 1752 (1984; R 1996e1) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

ASTM D 5249 (1995) Backer Material for Use With Cold and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints

## U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 513 (1974) Corps of Engineers Specifications for Rubber Waterstops

COE CRD-C 572 (1974) Corps of Engineers Specifications for Polyvinylchloride Waterstop

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office

that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Waterstops; G-DO

Shop drawings and fabrication drawings provided by the manufacturer or prepared by the Contractor.

SD-03 Product Data

Waterstops;

Manufacturer's literature for waterstops.

Manufacturer's recommended instructions for installing preformed fillers, field-molded sealants; preformed compression seals; and waterstops; and for splicing non-metallic waterstops.

SD-07 Certificates

Sealant;  
Waterstops;

Certificates of compliance stating that the joint filler and sealant materials and waterstops conform to the requirements specified.

1.3 DELIVERY AND STORAGE

Material delivered and placed in storage shall be stored off the ground and protected from moisture, dirt, and other contaminants. Sealants shall be delivered in the manufacturer's original unopened containers. Sealants whose shelf life has expired shall be removed from the site.

PART 2 PRODUCTS

2.1 CONTRACTION JOINT STRIPS

Contraction joint strips shall be 1/8 inch thick tempered hardboard conforming to AHA A135.4, Class 1. In lieu of hardboard strips, rigid polyvinylchloride (PVC) or high impact polystyrene (HIPS) insert strips specifically designed to induce controlled cracking in slabs on grade may be used. Such insert strips shall have removable top section.

2.2 PREFORMED EXPANSION JOINT FILLER

Expansion joint filler shall be preformed material conforming to ASTM D 1751 or ASTM D 1752. Unless otherwise indicated, filler material shall be 3/8 inch thick and of a width applicable for the joint formed. Backer material, when required, shall conform to ASTM D 5249.

2.3 SEALANT

Joint sealant shall conform to the following:

2.3.1 Field-Molded Type

ASTM C 920, Type M for horizontal joints or Type NS for vertical joints, Class 25, and Use NT. Bond breaker material shall be polyethylene tape, coated paper, metal foil or similar type materials. The back-up material shall be compressible, non-shrink, nonreactive with sealant, and non-absorptive material type such as extruded butyl or polychloroprene rubber.

## 2.4 WATERSTOPS

Intersection and change of direction waterstops shall be shop fabricated.

### 2.4.1 Non-Metallic Materials

Non-metallic waterstops shall be manufactured from a prime virgin resin; reclaimed material is not acceptable. The compound shall contain plasticizers, stabilizers, and other additives to meet specified requirements. Rubber waterstops shall conform to COE CRD-C 513. Polyvinylchloride waterstops shall conform to COE CRD-C 572. Thermoplastic elastomeric rubber waterstops shall conform to ASTM D 471.

## PART 3 EXECUTION

### 3.1 JOINTS

Joints shall be installed at locations indicated and as authorized.

#### 3.1.1 Contraction Joints

Contraction joints may be constructed by inserting tempered hardboard strips or rigid PVC or HIPS insert strips into the plastic concrete using a steel parting bar, when necessary, or by cutting the concrete with a saw after concrete has set. Joints shall be approximately 1/8 inch wide and shall extend into the slab one-fourth the slab thickness, minimum, but not less than 1 inch.

##### 3.1.1.1 Joint Strips

Strips shall be of the required dimensions and as long as practicable. After the first floating, the concrete shall be grooved with a tool at the joint locations. The strips shall be inserted in the groove and depressed until the top edge of the vertical surface is flush with the surface of the slab. The slab shall be floated and finished as specified. Working of the concrete adjacent to the joint shall be the minimum necessary to fill voids and consolidate the concrete. Where indicated, the top portion of the strip shall be sawed out after the curing period to form a recess for sealer. The removable section of PVC or HIPS strips shall be discarded and the insert left in place. True alignment of the strips shall be maintained during insertion.

##### 3.1.1.2 Sawed Joints

Joint sawing shall be early enough to prevent uncontrolled cracking in the slab, but late enough that this can be accomplished without appreciable spalling. Concrete sawing machines shall be adequate in number and power, and with sufficient replacement blades to complete the sawing at the required rate. Joints shall be cut to true alignment and shall be cut in sequence of concrete placement. Sludge and cutting debris shall be removed.

##### 3.1.2 Expansion Joints

Preformed expansion joint filler shall be used where indicated. The filler shall extend the full slab depth, or wall thickness. The edges of the joint shall be neatly finished with an edging tool of 1/8 inch radius, except where a resilient floor surface will be applied. Where the joint is to receive a sealant, the filler strips shall be installed at the proper level below the finished floor with a slightly tapered, dressed and oiled wood strip temporarily secured to the top to form a recess to the size shown on the drawings. The wood strip shall be removed after the concrete has set. Contractor may opt to use a removable expansion filler cap designed and fabricated for this purpose in lieu of the wood strip. The groove shall be thoroughly cleaned of laitance, curing compound, foreign materials, protrusions of hardened concrete, and any dust which shall be blown out of the groove with oil-free compressed air.

### 3.1.3 Joint Sealant

Sawed contraction joints and expansion joints in slabs shall be filled with joint sealant, unless otherwise shown. Joint surfaces shall be clean, dry, and free of oil or other foreign material which would adversely affect the bond between sealant and concrete. Joint sealant shall be applied as recommended by the manufacturer of the sealant.

#### 3.1.3.1 Joints With Field-Molded Sealant

Joints shall not be sealed when the sealant material, ambient air, or concrete temperature is less than 40 degrees F. When the sealants are meant to reduce the sound transmission characteristics of interior walls, ceilings, and floors the guidance provided in ASTM C 919 shall be followed. Joints requiring a bond breaker shall be coated with curing compound or with bituminous paint. Bond breaker and back-up material shall be installed where required. Joints shall be primed and filled flush with joint sealant in accordance with the manufacturer's recommendations.

### 3.2 WATERSTOPS, INSTALLATION AND SPLICES

Waterstops shall be installed at the locations shown to form a continuous water-tight diaphragm. Adequate provision shall be made to support and completely protect the waterstops during the progress of the work. Any waterstop punctured or damaged shall be repaired or replaced. Exposed waterstops shall be protected during application of form release agents to avoid being coated. Suitable guards shall be provided to protect exposed projecting edges and ends of partially embedded waterstops from damage when concrete placement has been discontinued. Splices shall be made by certified trained personnel using approved equipment and procedures.

#### 3.2.1 Non-Metallic

Fittings shall be shop made using a machine specifically designed to mechanically weld the waterstop. A miter guide, proper fixturing (profile dependant), and portable power saw shall be used to miter cut the ends to be joined to ensure good alignment and contact between joined surfaces. The splicing of straight lengths shall be done by squaring the ends to be joined. Continuity of the characteristic features of the cross section of the waterstop (ribs, tabular center axis, protrusions, etc.) shall be maintained across the splice.

##### 3.2.1.1 Rubber Waterstop

Splices shall be vulcanized or shall be made using cold bond adhesive as recommended by the manufacturer. Splices for TPE-R shall be as specified for PVC.

#### 3.2.1.2 Quality Assurance

Edge welding will not be permitted. Waterstop splicing defects which are unacceptable include, but are not limited to the following: 1) Tensile strength less than 80 percent of parent section. 2) Free lap joints. 3) Misalignment of centerbulb, ribs, and end bulbs greater than 1/16 inch. 4) Misalignment which reduces waterstop cross section more than 15 percent. 5) Bond failure at joint deeper than 1/16 inch or 15 percent of material thickness. 6) Misalignment of waterstop splice resulting in misalignment of waterstop in excess of 1/2 inch in 10 feet. 7) Visible porosity in the weld area, including pin holes. 8) Charred or burnt material. 9) Bubbles or inadequate bonding. 10) Visible signs of splice separation when cooled splice is bent by hand at a sharp angle.

### 3.3 CONSTRUCTION JOINTS

Construction joints are specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE except that construction joints coinciding with expansion and contraction joints shall be treated as expansion or contraction joints as applicable.

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SECTION 03200A

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**09/97**

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SECTION 03200A  
CONCRETE REINFORCEMENT  
09/97

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## ACI INTERNATIONAL (ACI)

ACI 318/318R (1995) Building Code Requirements for Structural Concrete and Commentary

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53 (1999) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A 185 (1997) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement

ASTM A 615/A 615M (1996a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

ASTM A 675/A 675M (1990a; R 1995e1) Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties

ASTM A 706/A 706M (1998) Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement

## CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI MSP-1 (1996) Manual of Standard Practice

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Reinforcement; G-DO

Detail drawings showing reinforcing steel placement, schedules, sizes, grades, and splicing and bending details. Drawings shall show support details including types, sizes and spacing.

#### SD-07 Certificates

##### Reinforcing Steel;

Certified copies of mill reports attesting that the reinforcing steel furnished contains no less than 25 percent recycled scrap steel and meets the requirements specified herein, prior to the installation of reinforcing steel.

#### 1.3 DELIVERY AND STORAGE

Reinforcement and accessories shall be stored off the ground on platforms, skids, or other supports.

### PART 2 PRODUCTS

#### 2.1 DOWELS

Dowels shall conform to ASTM A 675/A 675M, Grade 80. Steel pipe conforming to ASTM A 53, Schedule 80, may be used as dowels provided the ends are closed with metal or plastic inserts or with mortar.

#### 2.2 REINFORCING STEEL

Reinforcing steel shall be deformed bars conforming to ASTM A 615/A 615M or ASTM A 706/A 706M, grades and sizes as indicated.

#### 2.3 WELDED WIRE FABRIC

Welded wire fabric shall conform to ASTM A 185.

#### 2.4 WIRE TIES

Wire ties shall be 16 gauge or heavier black annealed steel wire.

#### 2.5 SUPPORTS

Bar supports for formed surfaces shall be designed and fabricated in accordance with CRSI MSP-1 and shall be steel or precast concrete blocks. Precast concrete blocks shall have wire ties and shall be not less than 4 inches square when supporting reinforcement on ground. Precast concrete block shall have compressive strength equal to that of the surrounding concrete. Where concrete formed surfaces will be exposed to weather or where surfaces are to be painted, steel supports within 1/2 inch of concrete surface shall be galvanized, plastic protected or of stainless steel. Concrete supports used in concrete exposed to view shall have the same color and texture as the finish surface. For slabs on grade, supports shall be precast concrete blocks, plastic coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of plastic.

### PART 3 EXECUTION

#### 3.1 REINFORCEMENT

Reinforcement shall be fabricated to shapes and dimensions shown and shall conform to the requirements of ACI 318/318R. Reinforcement shall be cold bent unless otherwise authorized. Bending may be accomplished in the field or at the mill. Bars shall not be bent after embedment in concrete. Safety caps shall be placed on all exposed ends of vertical concrete reinforcement bars that pose a danger to life safety. Wire tie ends shall face away from the forms.

### 3.1.1 Placement

Reinforcement shall be free from loose rust and scale, dirt, oil, or other deleterious coating that could reduce bond with the concrete. Reinforcement shall be placed in accordance with ACI 318/318R at locations shown plus or minus one bar diameter. Reinforcement shall not be continuous through expansion joints and shall be as indicated through construction or contraction joints. Concrete coverage shall be as indicated or as required by ACI 318/318R. If bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits or embedded items, the resulting arrangement of bars, including additional bars required to meet structural requirements, shall be approved before concrete is placed.

### 3.1.2 Splicing

Splices of reinforcement shall conform to ACI 318/318R and shall be made only as required or indicated. Splicing shall be by lapping or by mechanical connection; except that lap splices shall not be used for bars larger than No. 11 unless otherwise indicated. Lapped bars shall not be spaced farther apart than one-fifth the required length of lap or 6 inches. Mechanical butt splices shall be in accordance with the recommendation of the manufacturer of the mechanical splicing device. Butt splices shall develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices.

### 3.2 WELDED-WIRE FABRIC PLACEMENT

Welded-wire fabric shall be placed in slabs as indicated. Fabric placed in slabs on grade shall be continuous between expansion, construction, and contraction joints. Fabric placement at joints shall be as indicated. Lap splices shall be made in such a way that the overlapped area equals the distance between the outermost crosswires plus 2 inches. Laps shall be staggered to avoid continuous laps in either direction. Fabric shall be wired or clipped together at laps at intervals not to exceed 4 feet. Fabric shall be positioned by the use of supports.

### 3.3 DOWEL INSTALLATION

Dowels shall be installed in slabs on grade at locations indicated and at right angles to joint being doweled. Dowels shall be accurately positioned and aligned parallel to the finished concrete surface before concrete placement. Dowels shall be rigidly supported during concrete placement. One end of dowels shall be coated with a bond breaker.

-- End of Section --

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## SECTION 03300

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11/01

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## SECTION 03300

CAST-IN-PLACE STRUCTURAL CONCRETE  
11/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## ACI INTERNATIONAL (ACI)

ACI 117/117R	(1990; Errata) Standard Tolerances for Concrete Construction and Materials
ACI 211.1	(1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 214.3R	(1988; R 1997) Simplified Version of the Recommended Practice for Evaluation of Strength Test Results of Concrete
ACI 301	(1999) Standard Specifications for Structural Concrete
ACI 305R	(1999) Hot Weather Concreting
ACI 318/318R	(1999) Building Code Requirements for Structural Concrete and Commentary

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO M 182	(1991; R 1996) Burlap Cloth Made from Jute or Kenaf
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## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 31/C 31M	(2000e1) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(1999ae1) Concrete Aggregates
ASTM C 39/C 39M	(2001) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 42/C 42M	(1999) Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C 94/C 94M	(2000e2) Ready-Mixed Concrete
ASTM C 143/C 143M	(2000) Slump of Hydraulic Cement Concrete

ASTM C 150	(1999a) Portland Cement
ASTM C 171	(1997a) Sheet Materials for Curing Concrete
ASTM C 172	(1999) Sampling Freshly Mixed Concrete
ASTM C 192/C 192M	(2000) Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	(1997e1) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(2000) Air-Entraining Admixtures for Concrete
ASTM C 309	(1998a) Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 494/C 494M	(1999ae1) Chemical Admixtures for Concrete
ASTM C 552	(2000) Cellular Glass Thermal Insulation
ASTM C 578	(1995) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 591	(1994) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C 618	(2000) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 685	(2000) Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C 881	(1999) Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C 940	(1998a) Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory
ASTM C 1017/C 1017M	(1998) Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C 1059	(1999) Latex Agents for Bonding Fresh to Hardened Concrete
ASTM C 1064/C 1064M	(1999) Temperature of Freshly Mixed Portland Cement Concrete
ASTM C 1077	(1998) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM D 75	(1987; R 1997) Sampling Aggregates

## NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA CPMB 100	(1996) Concrete Plant Standards \n/c\$\X
NRMCA QC 3	(1984) Quality Control Manual: Section 3, Plant Certifications Checklist: Certification of Ready Mixed Concrete Production Facilities
NRMCA TMMB 100	(1994) Truck Mixer Agitator and Front Discharge Concrete Carrier Standards

## U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 400	(1963) Requirements for Water for Use in Mixing or Curing Concrete
COE CRD-C 521	(1981) Standard Test Method for Frequency and Amplitude of Vibrators for Concrete

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-03 Product Data

## Mixture Proportions; G-DO

The results of trial mixture design studies along with a statement giving the maximum nominal coarse aggregate size and the proportions of ingredients that will be used in the manufacture of each strength or class of concrete, at least 14 days prior to commencing concrete placing operations. Aggregate weights shall be based on the saturated surface dry condition. The statement shall be accompanied by test results from an approved independent commercial testing laboratory, showing that mixture design studies have been made with materials proposed for the project and that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the mixture design studies without additional tests to show that the quality of the concrete is satisfactory.

## SD-06 Test Reports

## Testing and Inspection for Contractor Quality ControlG-AO

Certified copies of laboratory test reports, including mill tests and all other test data, for portland cement, blended cement, pozzolan, aggregate, admixtures, and curing compound proposed for use on this project.

## SD-07 Certificates

## Qualifications; G-AO

Written documentation for Contractor Quality Control personnel.

1.3 QUALIFICATIONS

Contractor Quality Control personnel assigned to concrete construction shall be American Concrete Institute (ACI) Certified Workmen in one of the following grades or shall have written evidence of having completed similar qualification programs:

- Concrete Field Testing Technician, Grade I
- Concrete Laboratory Testing Technician, Grade I or II
- Concrete Construction Inspector, Level II

Concrete Transportation Construction Inspector or Reinforced Concrete Special Inspector, Jointly certified by American Concrete Institute (ACI), Building Official and Code Administrators International (BOCA), International Conference of Building Officials (ICBO), and Southern Building Code Congress International (SBCCI).

The foreman or lead journeyman of the flatwork finishing crew shall have similar qualification for ACI Concrete Flatwork Technician/Finisher or equal, with written documentation.

1.4 GENERAL REQUIREMENTS

1.4.1 Tolerances

Except as otherwise specified herein, tolerances for concrete batching, mixture properties, and construction as well as definition of terms and application practices shall be in accordance with ACI 117/117R. Level and grade tolerance measurements of slabs shall be made as soon as possible after finishing; when forms or shoring are used, the measurements shall be made prior to removal.

1.4.1.1 Floors

For the purpose of this Section the following terminology correlation between ACI 117/117R and this Section shall apply:

Floor Profile Quality Classification From ACI 117/117R	This Section
-----	-----
Conventional Bullfloated	Same
Conventional Straightedged	Same
Flat	Float Finish or Trowel Finish

Levelness tolerance shall not apply where design requires floors to be sloped to drains or sloped for other reasons.

1.4.1.2 Floors by the Straightedge System

The flatness of the floors shall be carefully controlled and the tolerances shall be measured by the straightedge system as specified in paragraph 4.5.7 of ACI 117/117R, using a 10 foot straightedge, within 72 hours after floor slab installation and before shores and/or forms are removed. The listed tolerances shall be met at any and every location at which the

straightedge can be placed.

Bullfloated 1/2-inch  
Straightedged 5/16-inch  
Float Finish 3/16-inch  
Trowel Finish 3/16-inch

#### 1.4.2 Strength Requirements and w/c Ratio

##### 1.4.2.1 Strength Requirements

Specified compressive strength (f'c) shall be 4000 psi for structural slabs and stoops and slabs-on-grade and docks, and 3,000 psi for footings and foundations walls and all other concrete. Concrete made with high-early strength cement shall have a 7-day strength equal to the specified 28-day strength. High-early strength cement shall not be permitted where sulfate-resistant cement is required by paragraph PORTLAND CEMENT. Compressive strength shall be determined in accordance with ASTM C 39/C 39M.

- a. Evaluation of Concrete Compressive Strength. Compressive strength specimens (6 by 12 inch cylinders) shall be fabricated by the Contractor and laboratory cured in accordance with ASTM C 31/C 31M and tested in accordance with ASTM C 39/C 39M. The strength of the concrete will be considered satisfactory so long as the average of all sets of three consecutive test results equals or exceeds the specified compressive strength f'c and no individual test result falls below the specified strength f'c by more than 500 psi. A "test" is defined as the average of two companion cylinders, or if only one cylinder is tested, the results of the single cylinder test. Additional analysis or testing, including taking cores and/or load tests may be required at the Contractor's expense when the strength of the concrete in the structure is considered potentially deficient.
- b. Investigation of Low-Strength Compressive Test Results. When any strength test of standard-cured test cylinders falls below the specified strength requirement by more than 500 psi or if tests of field-cured cylinders indicate deficiencies in protection and curing, steps shall be taken to assure that the load-carrying capacity of the structure is not jeopardized. When the strength of concrete in place is considered potentially deficient, cores shall be obtained and tested in accordance with ASTM C 42/C 42M. At least three representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores will be determined by the Contracting Officer to least impair the strength of the structure. Concrete in the area represented by the core testing will be considered adequate if the average strength of the cores is equal to at least 85 percent of the specified strength requirement and if no single core is less than 75 percent of the specified strength requirement. Non-destructive tests (tests other than test cylinders or cores) shall not be used as a basis for acceptance or rejection. The Contractor shall perform the coring and repair the holes. Cores will be tested by the Government.
- c. Load Tests. If the core tests are inconclusive or impractical to obtain or if structural analysis does not confirm the safety of the structure, load tests may be directed by the Contracting Officer in accordance with the requirements of ACI 318/318R.

Concrete work evaluated by structural analysis or by results of a load test as being understrength shall be corrected in a manner satisfactory to the Contracting Officer. All investigations, testing, load tests, and correction of deficiencies shall be performed by and at the expense of the Contractor and must be approved by the Contracting Officer, except that if all concrete is found to be in compliance with the drawings and specifications, the cost of investigations, testing, and load tests will be at the expense of the Government.

#### 1.4.2.2 Water-Cement Ratio

Maximum water-cement ratio (w/c) for normal weight concrete shall be 0.45 by weight. This w/c ratio may cause higher strengths than that required above for compressive or flexural strength. The maximum w/c required will be the equivalent w/c as determined by conversion from the weight ratio of water to cement plus pozzolan.

#### 1.4.3 Air Entrainment

Concrete shall be air entrained to contain between 4 and 7 percent total air, except that when the nominal maximum size coarse aggregate is 3/4 inch or smaller it shall be between 4.5 and 7.5 percent. Concrete with specified strength over 5000 psi may have 1.0 percent less air than specified above. Specified air content shall be attained at point of placement into the forms. Air content for normal weight concrete shall be determined in accordance with ASTM C 231.

#### 1.4.4 Slump

Slump of the concrete, as delivered to the point of placement into the forms, shall be within the following limits. Slump shall be determined in accordance with ASTM C 143/C 143M.

Structural Element	Slump	
	Minimum	Maximum
Walls, columns and beams	2 in.	4 in.
Foundation walls, substructure walls, footings, slabs	1 in.	3 in.
Any structural concrete approved for placement by pumping:		
At pump	2 in.	6 in.
At discharge of line	1 in.	4 in.

When use of a plasticizing admixture conforming to ASTM C 1017/C 1017M or when a Type F or G high range water reducing admixture conforming to ASTM C 494/C 494M is permitted to increase the slump of concrete, concrete shall have a slump of 2 to 4 inches before the admixture is added and a maximum slump of 8 inches at the point of delivery after the admixture is added.

#### 1.4.5 Concrete Temperature

The temperature of the concrete as delivered shall not exceed 90 degrees F.

When the ambient temperature during placing is 40 degrees F or less, or is expected to be at any time within 6 hours after placing, the temperature

of the concrete as delivered shall be between 55 and 75 degrees F.

#### 1.4.6 Size of Coarse Aggregate

The largest feasible nominal maximum size aggregate (NMSA) specified in paragraph AGGREGATES shall be used in each placement. However, nominal maximum size of aggregate shall not exceed any of the following: three-fourths of the minimum cover for reinforcing bars, three-fourths of the minimum clear spacing between reinforcing bars, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.

#### 1.4.7 Special Properties and Products

Concrete may contain admixtures other than air entraining agents, such as water reducers, superplasticizers, or set retarding agents to provide special properties to the concrete, if specified or approved. Any of these materials to be used on the project shall be used in the mix design studies.

### 1.5 MIXTURE PROPORTIONS

Concrete shall be composed of portland cement, other cementitious and pozzolanic materials as specified, aggregates, water and admixtures as specified.

#### 1.5.1 Proportioning Studies for Normal Weight Concrete

Trial design batches, mixture proportioning studies, and testing requirements for various classes and types of concrete specified shall be the responsibility of the Contractor. Mixture proportions shall be based on compressive strength as determined by test specimens fabricated in accordance with ASTM C 192/C 192M and tested in accordance with ASTM C 39/C 39M. Samples of all materials used in mixture proportioning studies shall be representative of those proposed for use in the project and shall be accompanied by the manufacturer's or producer's test reports indicating compliance with these specifications. Trial mixtures having proportions, consistencies, and air content suitable for the work shall be made based on methodology described in ACI 211.1, using at least three different water-cement ratios for each type of mixture, which will produce a range of strength encompassing those required for each class and type of concrete required on the project. If pozzolan is used in the concrete mixture, the minimum pozzolan content shall be 15 percent by weight of the total cementitious material, and the maximum shall be 35 percent. Laboratory trial mixtures shall be designed for maximum permitted slump and air content. Separate sets of trial mixture studies shall be made for each combination of cementitious materials and each combination of admixtures proposed for use. No combination of either shall be used until proven by such studies, except that, if approved in writing and otherwise permitted by these specifications, an accelerator or a retarder may be used without separate trial mixture study. Separate trial mixture studies shall also be made for concrete for any conveying or placing method proposed which requires special properties and for concrete to be placed in unusually difficult placing locations. The temperature of concrete in each trial batch shall be reported. For each water-cement ratio, at least three test cylinders for each test age shall be made and cured in accordance with ASTM C 192/C 192M. They shall be tested at 7 and 28 days in accordance with ASTM C 39/C 39M. From these test results, a curve shall be plotted showing the relationship between water-cement ratio and strength for each set of trial mix studies. In addition, a curve shall be plotted showing the

relationship between 7 day and 28 day strengths. Each mixture shall be designed to promote easy and suitable concrete placement, consolidation and finishing, and to prevent segregation and excessive bleeding.

#### 1.5.2 Average Compressive Strength Required for Mixtures

The mixture proportions selected during mixture design studies shall produce a required average compressive strength ( $f'_{cr}$ ) exceeding the specified compressive strength ( $f'_c$ ) by the amount indicated below. This required average compressive strength,  $f'_{cr}$ , will not be a required acceptance criteria during concrete production. However, whenever the daily average compressive strength at 28 days drops below  $f'_{cr}$  during concrete production, or daily average 7-day strength drops below a strength correlated with the 28-day  $f'_{cr}$ , the mixture shall be adjusted, as approved, to bring the daily average back up to  $f'_{cr}$ . During production, the required  $f'_{cr}$  shall be adjusted, as appropriate, based on the standard deviation being attained on the job.

##### 1.5.2.1 Computations from Test Records

Where a concrete production facility has test records, a standard deviation shall be established in accordance with the applicable provisions of ACI 214.3R. Test records from which a standard deviation is calculated shall represent materials, quality control procedures, and conditions similar to those expected; shall represent concrete produced to meet a specified strength or strengths ( $f'_c$ ) within 1,000 psi of that specified for proposed work; and shall consist of at least 30 consecutive tests. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days. Required average compressive strength  $f'_{cr}$  used as the basis for selection of concrete proportions shall be the larger of the equations that follow using the standard deviation as determined above:

$$f'_{cr} = f'_c + 1.34S \text{ where units are in psi}$$

$$f'_{cr} = f'_c + 2.33S - 500 \text{ where units are in psi}$$

Where  $S$  = standard deviation

Where a concrete production facility does not have test records meeting the requirements above but does have a record based on 15 to 29 consecutive tests, a standard deviation shall be established as the product of the calculated standard deviation and a modification factor from the following table:

NUMBER OF TESTS	MODIFICATION FACTOR FOR STANDARD DEVIATION
15	1.16
20	1.08
25	1.03
30 or more	1.00

##### 1.5.2.2 Computations without Previous Test Records

When a concrete production facility does not have sufficient field strength test records for calculation of the standard deviation, the required average strength  $f'_{cr}$  shall be determined as follows:

- a. If the specified compressive strength  $f'c$  is less than 3,000 psi,  
 $f'cr = f'c + 1000$  psi
- b. If the specified compressive strength  $f'c$  is 3,000 to 5,000 psi,  
 $f'cr = f'c + 1,200$  psi
- c. If the specified compressive strength  $f'c$  is over 5,000 psi,  
 $f'cr = f'c + 1,400$  psi

#### 1.6 STORAGE OF MATERIALS

Cement and other cementitious materials shall be stored in weathertight buildings, bins, or silos which will exclude moisture and contaminants and keep each material completely separated. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of aggregates. Aggregate shall not be stored directly on ground unless a sacrificial layer is left undisturbed. Reinforcing bars and accessories shall be stored above the ground on platforms, skids or other supports. Other materials shall be stored in such a manner as to avoid contamination and deterioration. Admixtures which have been in storage at the project site for longer than 6 months or which have been subjected to freezing shall not be used unless retested and proven to meet the specified requirements. Materials shall be capable of being accurately identified after bundles or containers are opened.

#### 1.7 GOVERNMENT ASSURANCE INSPECTION AND TESTING

Day-to day inspection and testing shall be the responsibility of the Contractor Quality Control (CQC) staff. However, representatives of the Contracting Officer can and will inspect construction as considered appropriate and will monitor operations of the Contractor's CQC staff. Government inspection or testing will not relieve the Contractor of any of his CQC responsibilities.

##### 1.7.1 Materials

The Government will sample and test aggregates, cementitious materials, other materials, and concrete to determine compliance with the specifications as considered appropriate. The Contractor shall provide facilities and labor as may be necessary for procurement of representative test samples. Samples of aggregates will be obtained at the point of batching in accordance with ASTM D 75. Other materials will be sampled from storage at the jobsite or from other locations as considered appropriate. Samples may be placed in storage for later testing when appropriate.

##### 1.7.2 Fresh Concrete

Fresh concrete will be sampled as delivered in accordance with ASTM C 172 and tested in accordance with these specifications, as considered necessary.

##### 1.7.3 Hardened Concrete

Tests on hardened concrete will be performed by the Government when such tests are considered necessary.

#### 1.7.4 Inspection

Concrete operations may be tested and inspected by the Government as the project progresses. Failure to detect defective work or material will not prevent rejection later when a defect is discovered nor will it obligate the Government for final acceptance.

### PART 2 PRODUCTS

#### 2.1 CEMENTITIOUS MATERIALS

Cementitious materials shall be portland cement, or portland cement in combination with pozzolan and shall conform to appropriate specifications listed below. Use of cementitious materials in concrete which will have surfaces exposed in the completed structure shall be restricted so there is no change in color, source, or type of cementitious material.

##### 2.1.1 Portland Cement

Portland cement shall conform to ASTM C 150 of one of the types listed below. All cement shall meet the optional chemical requirements for low alkali cement in Table 2 of ASTM C 150.

##### 2.1.1.1 Sulfate resistant cement

All concrete for footings and foundation walls and any other concrete in contact with soil or within 24-inches of soil, except for slabs placed over capillary water barrier and geomembrane vapor barrier, shall be made with sulfate-resistant cement of one of the types listed below:

Type II blended with pozzolan meeting the requirements of ASTM C 618, Type F, or

Type II having tricalcium aluminate content of less than 5 percent, or meeting the optional physical requirement for sulfate expansion for Type V cement in Table 4 of ASTM C 150, or

Type V.

##### 2.1.1.2 Other cement

Structural slabs, slabs placed over capillary water barrier and geomembrane water barrier, and other concrete which will not be within 24-inches of soil may be made with sulfate-resistant cement as specified above, or at the contractor's option may be made with Type I low alkali with a maximum 15 percent amount of tricalcium aluminate, or Type III with tricalcium aluminate limited to 5 percent. Type III shall be used only in specific areas of the structure, when approved in writing.

##### 2.1.2 Pozzolan (Fly Ash)

ASTM C 618, Class C or F with the optional requirements for multiple factor, drying shrinkage, and uniformity from Table 2A of ASTM C 618. . If pozzolan is used, it shall never be less than 15 percent nor more than 35 percent by weight of the total cementitious material. The Contractor shall comply with EPA requirements for recycled materials.

#### 2.2 AGGREGATES

Aggregates shall conform to the following.

#### 2.2.1 Fine Aggregate

Fine aggregate shall conform to the quality and gradation requirements of ASTM C 33.

#### 2.2.2 Coarse Aggregate

Coarse aggregate shall conform to ASTM C 33, Class 5S.

### 2.3 CHEMICAL ADMIXTURES

Chemical admixtures, when required or permitted, shall conform to the appropriate specification listed. Admixtures shall be furnished in liquid form and of suitable concentration for easy, accurate control of dispensing.

#### 2.3.1 Air-Entraining Admixture

ASTM C 260 and shall consistently entrain the air content in the specified ranges under field conditions.

#### 2.3.2 Accelerating Admixture

ASTM C 494/C 494M, Type C or E, except that calcium chloride or admixtures containing calcium chloride shall not be used.

#### 2.3.3 Water-Reducing or Retarding Admixture

ASTM C 494/C 494M, Type A, B, or D, except that the 6-month and 1-year compressive and flexural strength tests are waived.

#### 2.3.4 High-Range Water Reducer

ASTM C 494/C 494M, Type F or G, except that the 6-month and 1-year strength requirements are waived. The admixture shall be used only when approved in writing, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan and upon performance of separate mixture design studies.

### 2.4 CURING MATERIALS

#### 2.4.1 Impervious-Sheet

Impervious-sheet materials shall conform to ASTM C 171, type optional, except, that polyethylene sheet shall not be used.

#### 2.4.2 Membrane-Forming Compound

Membrane-Forming curing compound shall conform to ASTM C 309, Type 1-D or 2, except that only a styrene acrylate or chlorinated rubber compound meeting Class B requirements shall be used for surfaces that are to be painted or are to receive bituminous roofing, or waterproofing, or floors that are to receive adhesive applications of resilient flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing, or flooring specified. Nonpigmented compound shall contain a fugitive dye, and shall have the reflective requirements in ASTM C 309 waived.

#### 2.4.3 Burlap and Cotton Mat

Burlap and cotton mat used for curing shall conform to AASHTO M 182.

#### 2.5 WATER

Water for mixing and curing shall be fresh, clean, potable, and free of injurious amounts of oil, acid, salt, or alkali, except that non-potable water may be used if it meets the requirements of COE CRD-C 400.

#### 2.6 LATEX BONDING AGENT

Latex agents for bonding fresh to hardened concrete shall conform to ASTM C 1059.

#### 2.7 EPOXY RESIN

Epoxy resins for use in repairs shall conform to ASTM C 881, Type V, Grade 2. Class as appropriate to the existing ambient and surface temperatures.

#### 2.8 EMBEDDED ITEMS

Embedded items shall be of the size and type indicated or as needed for the application. Dovetail slots shall be galvanized steel. Hangers for suspended ceilings shall be as specified in Section 09510 ACOUSTICAL CEILINGS. Inserts for shelf angles and bolt hangers shall be of malleable iron or cast or wrought steel.

#### 2.9 PERIMETER INSULATION

Perimeter insulation shall be polystyrene conforming to ASTM C 578, Type II; polyurethane conforming to ASTM C 591, Type II; or cellular glass conforming to ASTM C 552, Type I or IV. The Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS.

#### 2.10 JOINT MATERIALS

Joint materials are specified in Section 03150a EXPANSION JOINTS AND WATERSTOPS.

### PART 3 EXECUTION

#### 3.1 PREPARATION FOR PLACING

Before commencing concrete placement, the following shall be performed. Surfaces to receive concrete shall be clean and free from frost, ice, mud, and water. Forms shall be in place, cleaned, coated, and adequately supported, in accordance with Section 03100a STRUCTURAL CONCRETE FORMWORK. Reinforcing steel shall be in place, cleaned, tied, and adequately supported, in accordance with Section 03200a CONCRETE REINFORCEMENT. Transporting and conveying equipment shall be in-place, ready for use, clean, and free of hardened concrete and foreign material. Equipment for consolidating concrete shall be at the placing site and in proper working order. Equipment and material for curing and for protecting concrete from weather or mechanical damage shall be at the placing site, in proper working condition and in sufficient amount for the entire placement. When hot, windy conditions during concreting appear probable, equipment and

material shall be at the placing site to provide windbreaks, shading, fogging, or other action to prevent plastic shrinkage cracking or other damaging drying of the concrete.

### 3.1.1 Foundations

#### 3.1.1.1 Concrete on Earth Foundations

Earth (subgrade, base, or subbase courses) surfaces upon which concrete is to be placed shall be clean, damp, and free from debris, frost, ice, and standing or running water. Prior to placement of concrete, the foundation shall be well drained and shall be satisfactorily graded and uniformly compacted.

#### 3.1.1.2 Excavated Surfaces in Lieu of Forms

Concrete for footings may be placed directly against the soil provided the earth or rock has been carefully trimmed, is uniform and stable, and meets the compaction requirements of Section 02315aEXCAVATION, FILLING, AND BACKFILLING FOR BUILDINGS. The concrete shall be placed without becoming contaminated by loose material, and the outline of the concrete shall be within the specified tolerances.

#### 3.1.2 Previously Placed Concrete

##### 3.1.2.1 Preparation of Previously Placed Concrete

Concrete surfaces to which other concrete is to be bonded shall be abraded in an approved manner that will expose sound aggregate uniformly without damaging the concrete. Laitance and loose particles shall be removed. Surfaces shall be thoroughly washed and shall be moist but without free water when concrete is placed.

##### 3.1.3 Perimeter Insulation

Perimeter insulation shall be installed at locations indicated. Adhesive shall be used where insulation is applied to the interior surface of foundation walls and may be used for exterior application.

##### 3.1.4 Embedded Items

Before placement of concrete, care shall be taken to determine that all embedded items are firmly and securely fastened in place as indicated on the drawings, or required. Conduit and other embedded items shall be clean and free of oil and other foreign matter such as loose coatings or rust, paint, and scale. The embedding of wood in concrete will be permitted only when specifically authorized or directed. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable materials to prevent the entry of concrete into voids. Welding shall not be performed on embedded metals within 1 foot of the surface of the concrete. Tack welding shall not be performed on or to embedded items.

### 3.2 CONCRETE PRODUCTION

Batch-type equipment shall be used for producing concrete. Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C 94/C 94M, except as otherwise specified. Truck mixers, agitators, and nonagitating transporting units shall comply with NRMCA TMMB 100. Ready-mix plant equipment and facilities shall be certified in accordance

with NRMCA QC 3. Approved batch tickets shall be furnished for each load of ready-mixed concrete. Site-mixed concrete shall be produced in accordance with ACI 301, and plant shall conform to NRMCA CPMB 100. In lieu of batch-type equipment, concrete may be produced by volumetric batching and continuous mixing, which shall conform to ASTM C 685.

### 3.3 TRANSPORTING CONCRETE TO PROJECT SITE

Concrete shall be transported to the placing site in truck mixers, agitators, or nonagitating transporting equipment conforming to NRMCA TMMB 100.

### 3.4 CONVEYING CONCRETE ON SITE

Concrete shall be conveyed from mixer or transporting unit to forms as rapidly as possible and within the time interval specified by methods which will prevent segregation or loss of ingredients using following equipment. Conveying equipment shall be cleaned before each placement.

#### 3.4.1 Buckets

The interior hopper slope shall be not less than 58 degrees from the horizontal, the minimum dimension of the clear gate opening shall be at least 5 times the nominal maximum-size aggregate, and the area of the gate opening shall not be less than 2 square feet. The maximum dimension of the gate opening shall not be greater than twice the minimum dimension. The bucket gates shall be essentially grout tight when closed and may be manually, pneumatically, or hydraulically operated except that buckets larger than 2 cubic yards shall not be manually operated. The design of the bucket shall provide means for positive regulation of the amount and rate of deposit of concrete in each dumping position.

#### 3.4.2 Trucks

Truck mixers operating at agitating speed or truck agitators used for transporting plant-mixed concrete shall conform to the requirements of ASTM C 94/C 94M. Nonagitating equipment shall be used only for transporting plant-mixed concrete over a smooth road and when the hauling time is less than 15 minutes. Bodies of nonagitating equipment shall be smooth, watertight, metal containers specifically designed to transport concrete, shaped with rounded corners to minimize segregation, and equipped with gates that will permit positive control of the discharge of the concrete.

#### 3.4.3 Chutes

When concrete can be placed directly from a truck mixer, agitator, or nonagitating equipment, the chutes normally attached to this equipment by the manufacturer may be used. A discharge deflector shall be used when required by the Contracting Officer. Separate chutes and other similar equipment will not be permitted for conveying concrete.

#### 3.4.4 Concrete Pumps

Concrete may be conveyed by positive displacement pump when approved. The pumping equipment shall be piston or squeeze pressure type; pneumatic placing equipment shall not be used. The pipeline shall be rigid steel pipe or heavy-duty flexible hose. The inside diameter of the pipe shall be at least 3 times the nominal maximum-size coarse aggregate in the concrete mixture to be pumped but not less than 4 inches. Aluminum pipe shall not

be used.

### 3.5 PLACING CONCRETE

Mixed concrete shall be discharged within 1-1/2 hours or before the mixer drum has revolved 300 revolutions, whichever comes first after the introduction of the mixing water to the cement and aggregates. When the concrete temperature exceeds 85 degrees F, the time shall be reduced to 45 minutes. Concrete shall be placed within 15 minutes after it has been discharged from the transporting unit. Concrete shall be handled from mixer or transporting unit to forms in a continuous manner until the approved unit of operation is completed. Adequate scaffolding, ramps and walkways shall be provided so that personnel and equipment are not supported by in-place reinforcement. Placing will not be permitted when the sun, heat, wind, or limitations of facilities furnished by the Contractor prevent proper consolidation, finishing and curing. Sufficient placing capacity shall be provided so that concrete can be kept free of cold joints.

#### 3.5.1 Depositing Concrete

Concrete shall be deposited as close as possible to its final position in the forms, and there shall be no vertical drop greater than 5 feet except where suitable equipment is provided to prevent segregation and where specifically authorized. Depositing of the concrete shall be so regulated that it will be effectively consolidated in horizontal layers not more than 12 inches thick, except that all slabs shall be placed in a single layer. Concrete to receive other construction shall be screeded to the proper level. Concrete shall be deposited continuously in one layer or in layers so that fresh concrete is deposited on in-place concrete that is still plastic. Fresh concrete shall not be deposited on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within the section. Concrete that has surface dried, partially hardened, or contains foreign material shall not be used. When temporary spreaders are used in the forms, the spreaders shall be removed as their service becomes unnecessary. Concrete shall not be placed in slabs over columns and walls until concrete in columns and walls has been in-place at least two hours or until the concrete begins to lose its plasticity. Concrete for beams, girders, brackets, column capitals, haunches, and drop panels shall be placed at the same time as concrete for adjoining slabs.

#### 3.5.2 Consolidation

Immediately after placing, each layer of concrete shall be consolidated by internal vibrators, except for slabs 4 inches thick or less. The vibrators shall at all times be adequate in effectiveness and number to properly consolidate the concrete; a spare vibrator shall be kept at the jobsite during all concrete placing operations. The vibrators shall have a frequency of not less than 10,000 vibrations per minute, an amplitude of at least 0.025 inch, and the head diameter shall be appropriate for the structural member and the concrete mixture being placed. Vibrators shall be inserted vertically at uniform spacing over the area of placement. The distance between insertions shall be approximately 1-1/2 times the radius of action of the vibrator so that the area being vibrated will overlap the adjacent just-vibrated area by a reasonable amount. The vibrator shall penetrate rapidly to the bottom of the layer and at least 6 inches into the preceding layer if there is such. Vibrator shall be held stationary until the concrete is consolidated and then vertically withdrawn slowly while operating. Form vibrators shall not be used unless specifically approved

and unless forms are constructed to withstand their use. Vibrators shall not be used to move concrete within the forms. Slabs 4 inches and less in thickness shall be consolidated by properly designed vibrating screeds or other approved technique. Excessive vibration of lightweight concrete resulting in segregation or flotation of coarse aggregate shall be prevented. Frequency and amplitude of vibrators shall be determined in accordance with COE CRD-C 521. Grate tampers ("jitterbugs") shall not be used.

### 3.5.3 Cold Weather Requirements

Special protection measures, approved by the Contracting Officer, shall be used if freezing temperatures are anticipated before the expiration of the specified curing period. The ambient temperature of the air where concrete is to be placed and the temperature of surfaces to receive concrete shall be not less than 40 degrees F. The temperature of the concrete when placed shall be not less than 50 degrees F nor more than 75 degrees F. Heating of the mixing water or aggregates will be required to regulate the concrete placing temperature. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Upon written approval, an accelerating admixture conforming to ASTM C 494/C 494M, Type C or E may be used, provided it contains no calcium chloride. Calcium chloride shall not be used.

### 3.5.4 Hot Weather Requirements

When the ambient temperature during concrete placing is expected to exceed 85 degrees F, the concrete shall be placed and finished with procedures previously submitted and as specified herein. The concrete temperature at time of delivery to the forms shall not exceed the temperature shown in the table below when measured in accordance with ASTM C 1064/C 1064M. Cooling of the mixing water or aggregates or placing concrete in the cooler part of the day may be required to obtain an adequate placing temperature. A retarder may be used, as approved, to facilitate placing and finishing. Steel forms and reinforcements shall be cooled as approved prior to concrete placement when steel temperatures are greater than 120 degrees F. Conveying and placing equipment shall be cooled if necessary to maintain proper concrete-placing temperature.

#### Maximum Allowable Concrete Placing Temperature

Relative Humidity, Percent, During Time of Concrete Placement	Maximum Allowable Concrete Temperature Degrees
Greater than 60	90 F
40-60	85 F
Less than 40	80 F

### 3.5.5 Prevention of Plastic Shrinkage Cracking

During hot weather with low humidity, and particularly with appreciable wind, as well as interior placements when space heaters produce low humidity, the Contractor shall be alert to the tendency for plastic shrinkage cracks to develop and shall institute measures to prevent this. Particular care shall be taken if plastic shrinkage cracking is potentially imminent and especially if it has developed during a previous placement.

Periods of high potential for plastic shrinkage cracking can be anticipated by use of Fig. 2.1.5 of ACI 305R. In addition the concrete placement shall be further protected by erecting shades and windbreaks and by applying fog sprays of water, sprinkling, ponding or wet covering. Plastic shrinkage cracks that occur shall be filled by injection of epoxy resin as directed, after the concrete hardens. Plastic shrinkage cracks shall never be troweled over or filled with slurry.

### 3.5.6 Placing Concrete in Congested Areas

Special care shall be used to ensure complete filling of the forms, elimination of all voids, and complete consolidation of the concrete when placing concrete in areas congested with reinforcing bars, embedded items, waterstops and other tight spacing. An appropriate concrete mixture shall be used, and the nominal maximum size of aggregate (NMSA) shall meet the specified criteria when evaluated for the congested area. Vibrators with heads of a size appropriate for the clearances available shall be used, and the consolidation operation shall be closely supervised to ensure complete and thorough consolidation at all points. Where necessary, splices of reinforcing bars shall be alternated to reduce congestion. Where two mats of closely spaced reinforcing are required, the bars in each mat shall be placed in matching alignment to reduce congestion. Reinforcing bars may be temporarily crowded to one side during concrete placement provided they are returned to exact required location before concrete placement and consolidation are completed.

## 3.6 JOINTS

Joints shall be located and constructed as indicated or approved. Joints not indicated on the drawings shall be located and constructed to minimize the impact on the strength of the structure. In general, such joints shall be located near the middle of the spans of supported slabs, beams, and girders unless a beam intersects a girder at this point, in which case the joint in the girder shall be offset a distance equal to twice the width of the beam. Joints in walls and columns shall be at the underside of floors, slabs, beams, or girders and at the tops of footings or floor slabs, unless otherwise approved. Joints shall be perpendicular to the main reinforcement. All reinforcement shall be continued across joints; except that reinforcement or other fixed metal items shall not be continuous through expansion joints, or through construction or contraction joints in slabs on grade. Reinforcement shall be 2 inches clear from each joint. Except where otherwise indicated, construction joints between interior slabs on grade and vertical surfaces shall consist of 30 pound asphalt-saturated felt, extending for the full depth of the slab. The perimeters of the slabs shall be free of fins, rough edges, spalling, or other unsightly appearance. Reservoir for sealant for construction and contraction joints in slabs shall be formed to the dimensions shown on the drawings by removing snap-out joint-forming inserts, by sawing sawable inserts, or by sawing to widen the top portion of sawed joints. Joints to be sealed shall be cleaned and sealed as indicated and in accordance with Section 03150a EXPANSION JOINTS, CONTRACTION JOINTS AND WATERSTOPS.

### 3.6.1 Construction Joints

For concrete other than slabs on grade, construction joints shall be located so that the unit of operation does not exceed 60 feet. Concrete shall be placed continuously so that each unit is monolithic in construction. Fresh concrete shall not be placed against adjacent hardened concrete until it is at least 24 hours old. Construction joints shall be

located as indicated or approved. Where concrete work is interrupted by weather, end of work shift or other similar type of delay, location and type of construction joint shall be subject to approval of the Contracting Officer. Unless otherwise indicated and except for slabs on grade, reinforcing steel shall extend through construction joints. Construction joints in slabs on grade shall be keyed or doweled as shown. Concrete columns, walls, or piers shall be in place at least 2 hours, or until the concrete begins to lose its plasticity, before placing concrete for beams, girders, or slabs thereon. In walls having door or window openings, lifts shall terminate at the top and bottom of the opening. Other lifts shall terminate at such levels as to conform to structural requirements or architectural details. Where horizontal construction joints in walls or columns are required, a strip of 1 inch square-edge lumber, bevelled and oiled to facilitate removal, shall be tacked to the inside of the forms at the construction joint. Concrete shall be placed to a point 1 inch above the underside of the strip. The strip shall be removed 1 hour after the concrete has been placed, and any irregularities in the joint line shall be leveled off with a wood float, and all laitance shall be removed. Prior to placing additional concrete, horizontal construction joints shall be prepared as specified in paragraph Previously Placed Concrete.

### 3.6.2 Expansion Joints and Contraction Joints in Slabs on Grade

See Section 03150a EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS

### 3.6.3 Waterstops

Waterstops shall be installed in conformance with the locations and details shown on the drawings using materials and procedures specified in Section 03150a EXPANSION JOINTS AND WATERSTOPS.

### 3.6.4 Dowels

Dowels shall be installed at the locations shown on the drawings and to the details shown, using materials and procedures specified in Section 03200a CONCRETE REINFORCEMENT and herein. Conventional smooth "paving" dowels shall be installed in slabs using approved methods to hold the dowel in place during concreting within a maximum alignment tolerance of 1/8 inch in 12 inches. Care shall be taken during placing adjacent to and around dowels and tie bars to ensure there is no displacement of the dowel and that the concrete completely embeds the dowel or tie bar and is thoroughly consolidated.

## 3.7 FINISHING FORMED SURFACES

Forms, form materials, and form construction are specified in Section 03100a STRUCTURAL CONCRETE FORMWORK. Finishing of formed surfaces shall be as specified herein. Unless another type of architectural or special finish is specified, surfaces shall be left with the texture imparted by the forms except that defective surfaces shall be repaired. Unless painting of surfaces is required, uniform color of the concrete shall be maintained by use of only one mixture without changes in materials or proportions for any structure or portion of structure that requires a Class A or B finish. Except for major defects, as defined hereinafter, surface defects shall be repaired as specified herein within 24 hours after forms are removed. Repairs of the so-called "plaster-type" will not be permitted in any location. Tolerances of formed surfaces shall conform to the requirements of ACI 117/117R. These tolerances apply to the finished concrete surface, not to the forms themselves; forms shall be set true to line and grade.

Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter shall be repaired as specified in paragraph Damp-Pack Mortar Repair. Defects whose surface diameter is greater than their depth shall be repaired as specified in paragraph Repair of Major Defects. Repairs shall be finished flush with adjacent surfaces and with the same surface texture. The cement used for all repairs shall be a blend of job cement with white cement proportioned so that the final color after curing and aging will be the same as the adjacent concrete. Concrete with excessive honeycomb, or other defects which affect the strength of the member, will be rejected. Repairs shall be demonstrated to be acceptable and free from cracks or loose or drummy areas at the completion of the contract and, for Class A and B Finishes, shall be inconspicuous. Repairs not meeting these requirements will be rejected and shall be replaced.

#### 3.7.1 Class B Finish

Class B finish is required on all surfaces exposed to view. Fins, ravelings, and loose material shall be removed, all surface defects over 1/2 inch in diameter or more than 1/2 inch deep, shall be repaired and, except as otherwise indicated or as specified in Section 03100a STRUCTURAL CONCRETE FORMWORK, holes left by removal of form ties shall be reamed and filled. Defects more than 1/2 inch in diameter shall be cut back to sound concrete, but in all cases at least 1 inch deep. The Contractor shall prepare a sample panel for approval (as specified in PART 1) before commencing repair, showing that the surface texture and color match will be attained. Metal tools shall not be used to finish repairs in Class A surfaces.

#### 3.7.2 Class D Finish

Class D finish is required on all surfaces which will not be exposed to view in the finished structure. Fins, ravelings, and loose material shall be removed, and, except as otherwise indicated or as specified in Section 03100a STRUCTURAL CONCRETE FORMWORK, holes left by removal of form ties shall be reamed and filled. Honeycomb and other defects more than 1/2 inch deep or more than 2 inches in diameter shall be repaired. Defects more than 2 inches in diameter shall be cut back to sound concrete, but in all cases at least 1 inch deep.

#### 3.7.3 Concrete Sealer

Concrete finishes for the vehicle vestibules (Rms. 141 & 152) and the entire drive-through area (Rm. 145) shall not have a concrete hardener and / or sealer applied. Floor surfaces in these locations shall have a concrete sealer applied in accordance with specification SECTION: 09990 PAINTS AND COATINGS.

### 3.8 REPAIRS

#### 3.8.1 Damp-Pack Mortar Repair

Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter but not over 4 inches shall be repaired by the damp-pack mortar method. Form tie holes shall be reamed and other similar defects shall be cut out to sound concrete. The void shall then be thoroughly cleaned, thoroughly wetted, brush-coated with a thin coat of neat cement grout and filled with mortar. Mortar shall be a stiff mix of 1 part portland cement to 2 parts fine aggregate passing the No. 16 mesh

sieve, and minimum amount of water. Only sufficient water shall be used to produce a mortar which, when used, will stick together on being molded into a ball by a slight pressure of the hands and will not exude water but will leave the hands damp. Mortar shall be mixed and allowed to stand for 30 to 45 minutes before use with remixing performed immediately prior to use. Mortar shall be thoroughly tamped in place in thin layers using a hammer and hardwood block. Holes passing entirely through walls shall be completely filled from the inside face by forcing mortar through to the outside face. All holes shall be packed full. Damp-pack repairs shall be moist cured for at least 48 hours.

### 3.8.2 Repair of Major Defects

Major defects will be considered to be those more than 1/2 inch deep or, for Class A and B finishes, more than 1/2 inch in diameter and, for Class C and D finishes, more than 2 inches in diameter. Also included are any defects of any kind whose depth is over 4 inches or whose surface diameter is greater than their depth. Major defects shall be repaired as specified below.

#### 3.8.2.1 Surface Application of Mortar Repair

Defective concrete shall be removed, and removal shall extend into completely sound concrete. Approved equipment and procedures which will not cause cracking or microcracking of the sound concrete shall be used. If reinforcement is encountered, concrete shall be removed so as to expose the reinforcement for at least 2 inches on all sides. All such defective areas greater than 12 square inches shall be outlined by saw cuts at least 1 inch deep. Defective areas less than 12 square inches shall be outlined by a 1 inch deep cut with a core drill in lieu of sawing. All saw cuts shall be straight lines in a rectangular pattern in line with the formwork panels. After concrete removal, the surface shall be thoroughly cleaned by high pressure washing to remove all loose material. Surfaces shall be kept continually saturated for the first 12 of the 24 hours immediately before placing mortar and shall be damp but not wet at the time of commencing mortar placement. The Contractor, at his option, may use either hand-placed mortar or mortar placed with a mortar gun. If hand-placed mortar is used, the edges of the cut shall be perpendicular to the surface of the concrete. The prepared area shall be brush-coated with a thin coat of neat cement grout. The repair shall then be made using a stiff mortar, preshrunk by allowing the mixed mortar to stand for 30 to 45 minutes and then remixed, thoroughly tamped into place in thin layers. If hand-placed mortar is used, the Contractor shall test each repair area for drumminess by firm tapping with a hammer and shall inspect for cracks, both in the presence of the Contracting Officer's representative, immediately before completion of the contract, and shall replace any showing drumminess or cracking. If mortar placed with a mortar gun is used, the gun shall be a small compressed air-operated gun to which the mortar is slowly hand fed and which applies the mortar to the surface as a high-pressure stream, as approved. Repairs made using shotcrete equipment will not be accepted. The mortar used shall be the same mortar as specified for damp-pack mortar repair. If gun-placed mortar is used, the edges of the cut shall be beveled toward the center at a slope of 1:1. All surface applied mortar repairs shall be continuously moist cured for at least 7 days. Moist curing shall consist of several layers of saturated burlap applied to the surface immediately after placement is complete and covered with polyethylene sheeting, all held closely in place by a sheet of plywood or similar material rigidly braced against it. Burlap shall be kept continually wet.

### 3.8.2.2 Repair of Deep and Large Defects

Deep and large defects will be those that are more than 6 inches deep and also have an average diameter at the surface more than 18 inches or that are otherwise so identified by the Project Office. Such defects shall be repaired as specified herein or directed, except that defects which affect the strength of the structure shall not be repaired and that portion of the structure shall be completely removed and replaced. Deep and large defects shall be repaired by procedures approved in advance including forming and placing special concrete using applied pressure during hardening. Preparation of the repair area shall be as specified for surface application of mortar. In addition, the top edge (surface) of the repair area shall be sloped at approximately 20 degrees from the horizontal, upward toward the side from which concrete will be placed. The special concrete shall be a concrete mixture with low water content and low slump, and shall be allowed to age 30 to 60 minutes before use. Concrete containing a specified expanding admixture may be used in lieu of the above mixture; the paste portion of such concrete mixture shall be designed to have an expansion between 2.0 and 4.0 percent when tested in accordance with ASTM C 940. A full width "chimney" shall be provided at the top of the form on the placing side to ensure filling to the top of the opening. A pressure cap shall be used on the concrete in the chimney with simultaneous tightening and revibrating the form during hardening to ensure a tight fit for the repair. The form shall be removed after 24 hours and immediately the chimney shall be carefully chipped away to avoid breaking concrete out of the repair; the surface of the repair concrete shall be dressed as required.

## 3.9 FINISHING UNFORMED SURFACES

The finish of all unformed surfaces shall meet the requirements of paragraph Tolerances in PART 1, when tested as specified herein.

### 3.9.1 General

The ambient temperature of spaces adjacent to unformed surfaces being finished and of the base on which concrete will be placed shall be not less than 50 degrees F. In hot weather all requirements of paragraphs Hot Weather Requirements and Prevention of Plastic Shrinkage Cracking shall be met. Unformed surfaces that are not to be covered by additional concrete or backfill shall have a float finish, with additional finishing as specified below, and shall be true to the elevation shown on the drawings. Surfaces to receive additional concrete or backfill shall be brought to the elevation shown on the drawings, properly consolidated, and left true and regular. Unless otherwise shown on the drawings, exterior surfaces shall be sloped for drainage, as directed. Where drains are provided, interior floors shall be evenly sloped to the drains. Joints shall be carefully made with a jointing or edging tool. The finished surfaces shall be protected from stains or abrasions. Grate tampers or "jitterbugs" shall not be used for any surfaces. The dusting of surfaces with dry cement or other materials or the addition of any water during finishing shall not be permitted. If bleedwater is present prior to finishing, the excess water shall be carefully dragged off or removed by absorption with porous materials such as burlap. During finishing operations, extreme care shall be taken to prevent over finishing or working water into the surface; this can cause "crazing" (surface shrinkage cracks which appear after hardening) of the surface. Any slabs with surfaces which exhibit significant crazing shall be removed and replaced. During finishing operations, surfaces shall

be checked with a 10 foot straightedge, applied in both directions at regular intervals while the concrete is still plastic, to detect high or low areas.

### 3.9.2 Rough Slab Finish

As a first finishing operation for unformed surfaces, the surface shall receive a rough slab finish prepared as follows. The concrete shall be uniformly placed across the slab area, consolidated as previously specified, and then screeded with straightedge strikeoffs immediately after consolidation to bring the surface to the required finish level with no coarse aggregate visible. Side forms and screed rails shall be provided, rigidly supported, and set to exact line and grade. Allowable tolerances for finished surfaces apply only to the hardened concrete, not to forms or screed rails. Forms and screed rails shall be set true to line and grade. "Wet screeds" shall not be used.

### 3.9.3 Floated Finish

All slabs shall next be given a wood float finish. The screeding shall be followed immediately by darbying or bull floating before bleeding water is present, to bring the surface to a true, even plane. Then, after the concrete has stiffened so that it will withstand a man's weight without imprint of more than 1/4 inch and the water sheen has disappeared, it shall be floated to a true and even plane free of ridges. Floating shall be performed by use of suitable hand floats or power driven equipment. Sufficient pressure shall be used on the floats to bring a film of moisture to the surface. Hand floats shall be made of wood, magnesium, or aluminum. Lightweight concrete or concrete that exhibits stickiness shall be floated with a magnesium float. Care shall be taken to prevent over-finishing or incorporating water into the surface.

### 3.9.4 Troweled Finish

All slabs shall be given a trowel finish. After floating is complete and after the surface moisture has disappeared, unformed surfaces shall be steel-troweled to a smooth, even, dense finish, free from blemishes including trowel marks. In lieu of hand finishing, an approved power finishing machine may be used in accordance with the directions of the machine manufacturer. Additional trowelings shall be performed, either by hand or machine until the surface has been troweled 2 times, with waiting period between each. Care shall be taken to prevent blistering and if such occurs, troweling shall immediately be stopped and operations and surfaces corrected. A final hard steel troweling shall be done by hand, with the trowel tipped, and using hard pressure, when the surface is at a point that the trowel will produce a ringing sound. The finished surface shall be thoroughly consolidated and shall be essentially free of trowel marks and be uniform in texture and appearance. The concrete mixture used for troweled finished areas shall be adjusted, if necessary, in order to provide sufficient fines (cementitious material and fine sand) to finish properly.

### 3.9.5 Broomed Finish

A broomed finish shall be given to the exterior stoops, and the sloping ramps from the drive-thru to hatchery area room 145. After floating, the surface shall be lightly steel troweled, and then carefully scored by pulling a soft, coarse fiber push-type broom across the surface. Brooming shall be transverse to traffic or at right angles to the slope of the slab.

After the end of the curing period, the surface shall be vigorously broomed with a coarse fiber broom to remove all loose or semi-detached particles.

### 3.10 CURING AND PROTECTION

#### 3.10.1 General

Concrete shall be cured by an approved method for the period of time given below:

Concrete with Type III cement (where permitted)	3 days
All other concrete	7 days

Immediately after placement, concrete shall be protected from premature drying, extremes in temperatures, rapid temperature change, mechanical injury and damage from rain and flowing water for the duration of the curing period. Air and forms in contact with concrete shall be maintained at a temperature above 50 degrees F for the first 3 days and at a temperature above 32 degrees F for the remainder of the specified curing period. Exhaust fumes from combustion heating units shall be vented to the outside of the enclosure, and heaters and ducts shall be placed and directed so as not to cause areas of overheating and drying of concrete surfaces or to create fire hazards. Materials and equipment needed for adequate curing and protection shall be available and at the site prior to placing concrete. No fire or excessive heat, including welding, shall be permitted near or in direct contact with the concrete at any time. Except as otherwise permitted by paragraph Membrane Forming Curing Compounds, moist curing shall be provided for any areas to receive floor hardener, any paint or other applied coating, or to which other concrete is to be bonded.

Concrete containing silica fume shall be initially cured by fog misting during finishing, followed immediately by continuous moist curing. Except for plastic coated burlap, impervious sheeting alone shall not be used for curing.

#### 3.10.2 Moist Curing

Concrete to be moist-cured shall be maintained continuously wet for the entire curing period, commencing immediately after finishing. If water or curing materials used stain or discolor concrete surfaces which are to be permanently exposed, the concrete surfaces shall be cleaned as approved. When wooden forms are left in place during curing, they shall be kept wet at all times. If steel forms are used in hot weather, nonsupporting vertical forms shall be broken loose from the concrete soon after the concrete hardens and curing water continually applied in this void. If the forms are removed before the end of the curing period, curing shall be carried out as on unformed surfaces, using suitable materials. Surfaces shall be cured by ponding, by continuous sprinkling, by continuously saturated burlap or cotton mats, or by continuously saturated plastic coated burlap. Burlap and mats shall be clean and free from any contamination and shall be completely saturated before being placed on the concrete. The Contractor shall have an approved work system to ensure that moist curing is continuous 24 hours per day.

#### 3.10.3 Membrane Forming Curing Compounds

Membrane curing shall not be used on surfaces that are to receive any subsequent treatment depending on adhesion or bonding to the concrete, including surfaces to which a smooth finish is to be applied or other

concrete or mortar setting be or mortar bond coat is to be bonded. However, a styrene acrylate or chlorinated rubber compound meeting ASTM C 309, Class B requirements, may be used for surfaces which are to be painted or are to receive bituminous roofing or waterproofing, or floors that are to receive adhesive applications of resilient flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing or flooring specified. Membrane curing compound shall not be used on surfaces that are maintained at curing temperatures with free steam. Curing compound shall be applied to formed surfaces immediately after the forms are removed and prior to any patching or other surface treatment except the cleaning of loose sand, mortar, and debris from the surface. All surfaces shall be thoroughly moistened with water. Curing compound shall be applied to slab surfaces as soon as the bleeding water has disappeared, with the tops of joints being temporarily sealed to prevent entry of the compound and to prevent moisture loss during the curing period. The curing compound shall be applied in a two-coat continuous operation by approved motorized power-spraying equipment operating at a minimum pressure of 75 psi, at a uniform coverage of not more than 400 square feet per gallon for each coat, and the second coat shall be applied perpendicular to the first coat. Concrete surfaces which have been subjected to rainfall within 3 hours after curing compound has been applied shall be resprayed by the method and at the coverage specified. Surfaces on which clear compound is used shall be shaded from direct rays of the sun for the first 3 days. Surfaces coated with curing compound shall be kept free of foot and vehicular traffic, and from other sources of abrasion and contamination during the curing period.

#### 3.10.4 Impervious Sheeting

Impervious-sheet curing shall only be used on horizontal or nearly horizontal surfaces. Surfaces shall be thoroughly wetted and be completely covered with the sheeting. Sheeting shall be at least 18 inches wider than the concrete surface to be covered. Covering shall be laid with light-colored side up. Covering shall be lapped not less than 12 inches and securely weighted down or shall be lapped not less than 4 inches and taped to form a continuous cover with completely closed joints. The sheet shall be weighted to prevent displacement so that it remains in contact with the concrete during the specified length of curing. Coverings shall be folded down over exposed edges of slabs and secured by approved means. Sheets shall be immediately repaired or replaced if tears or holes appear during the curing period.

#### 3.10.5 Ponding or Immersion

Concrete shall be continually immersed throughout the curing period. Water shall not be more than 20 degrees F less than the temperature of the concrete.

#### 3.10.6 Cold Weather Curing and Protection

When the daily ambient low temperature is less than 32 degrees F the temperature of the concrete shall be maintained above 40 degrees F for the first seven days after placing. During the period of protection removal, the air temperature adjacent to the concrete surfaces shall be controlled so that concrete near the surface will not be subjected to a temperature differential of more than 25 degrees F as determined by suitable temperature measuring devices furnished by the Contractor, as required, and installed adjacent to the concrete surface and 2 inches inside the surface of the concrete. The installation of the thermometers shall be made by the

Contractor as directed.

### 3.11 SETTING BASE PLATES AND BEARING PLATES

After being properly positioned, column base plates, bearing plates for beams and similar structural members, and machinery and equipment base plates shall be set to the proper line and elevation with damp-pack bedding mortar. The thickness of the mortar or grout shall be approximately 1/24 the width of the plate, but not less than 3/4 inch. Concrete and metal surfaces in contact with grout shall be clean and free of oil and grease, and concrete surfaces in contact with grout shall be damp and free of laitance when grout is placed.

#### 3.11.1 Damp-Pack Bedding Mortar

Damp-pack bedding mortar shall consist of 1 part cement and 2-1/2 parts fine aggregate having water content such that a mass of mortar tightly squeezed in the hand will retain its shape but will crumble when disturbed. The space between the top of the concrete and bottom of the bearing plate or base shall be packed with the bedding mortar by tamping or ramming with a bar or rod until it is completely filled.

### 3.12 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL

The Contractor shall perform the inspection and tests described below and, based upon the results of these inspections and tests, shall take the action required and shall submit specified reports. When, in the opinion of the Contracting Officer, the concreting operation is out of control, concrete placement shall cease and the operation shall be corrected. The laboratory performing the tests shall be onsite and shall conform with ASTM C 1077. Materials may be subjected to check testing by the Government from samples obtained at the manufacturer, at transfer points, or at the project site.

#### 3.12.1 Concrete Mixture

- a. Air Content Testing. Air content tests shall be made when test specimens are fabricated. In addition, at least two tests for air content shall be made on randomly selected batches of each separate concrete mixture produced during each 8-hour period of concrete production. Additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Tests shall be made in accordance with ASTM C 231. Samples for air content may be taken at the mixer, however, the Contractor is responsible for delivering the concrete to the placement site at the stipulated air content. If the Contractor's materials or transportation methods cause air content loss between the mixer and the placement, correlation samples shall be taken at the placement site as required by the Contracting Officer, and the air content at the mixer controlled as directed.
- b. Air Content Corrective Action. Whenever air content approaches either the upper or lower limit, an adjustment shall immediately be made in the amount of air-entraining admixture batched. As soon as practical after each adjustment, another test shall be made to verify the result of the adjustment, and the admixture dispenser shall be recalibrated to ensure that it is operating accurately and with good reproducibility. Whenever air content

approaches either the upper or lower, the air content shall be considered out of control and the concreting operation shall immediately be halted until the air content is under control. Additional air content tests shall be made when concreting is restarted.

- c. Slump Testing. In addition to slump tests which shall be made when test specimens are fabricated, at least four slump tests shall be made on randomly selected batches in accordance with ASTM C 143/C 143M for each separate concrete mixture produced during each 8-hour or less period of concrete production each day. Also, additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. When a single slump test reaches or goes beyond either the upper or lower limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the slump of the batch for determining need for any remedial action. Samples for slump shall be taken at the mixer. However, the Contractor is responsible for delivering the concrete to the placement site at the stipulated slump. If the Contractor's materials or transportation methods cause slump loss between the mixer and the placement, correlation samples shall be taken at the placement site as required by the Contracting Officer, and the slump at the mixer controlled as directed.
- d. Slump Corrective Action. Whenever slump reaches the upper limit, an adjustment shall immediately be made in the batch weights of water and fine aggregate. The adjustments are to be made so that the total water content does not exceed that amount allowed by the maximum w/c ratio specified, based on aggregates which are in a saturated surface dry condition. When a single slump reaches the upper or lower limit, no further concrete shall be delivered to the placing site until proper adjustments have been made. Immediately after each adjustment, another test shall be made to verify the correctness of the adjustment. Whenever two consecutive individual slump tests, made during a period when there was no adjustment of batch weights, reach the upper limit, the concreting operation shall immediately be halted, and the Contractor shall take appropriate steps to bring the slump under control. Additional slump tests shall be made as directed.
- e. Temperature. The temperature of the concrete shall be measured when compressive strength specimens are fabricated. Measurement shall be in accordance with ASTM C 1064/C 1064M. The temperature shall be reported along with the compressive strength data.
- f. Strength Specimens. At least one set of test specimens shall be made, for compressive or flexural strength as appropriate, on each different concrete mixture placed during the day for each 500 cubic yards or portion thereof of that concrete mixture placed each day. Additional sets of test specimens shall be made, as directed by the Contracting Officer, when the mixture proportions are changed or when low strengths have been detected. A truly random (not haphazard) sampling plan shall be developed by the Contractor and approved by the Contracting Officer prior to the start of construction. The plan shall assure that sampling is done in a completely random and unbiased manner. A set of test specimens for concrete with a 28-day specified strength per paragraph Strength Requirements in PART 1 shall consist of four

specimens, two to be tested at 7 days and two at 28 days. Test specimens shall be molded and cured in accordance with ASTM C 31/C 31M and tested in accordance with ASTM C 39/C 39M for test cylinders. Results of all strength tests shall be reported immediately to the Contracting Officer. Quality control charts shall be kept for individual strength "tests", ("test" as defined in paragraph Strength Requirements in PART 1) moving average of last 3 "tests" for strength, and moving average for range for the last 3 "tests" for each mixture. The charts shall be similar to those found in ACI 214.3R.

#### 3.12.2 Inspection Before Placing

Foundations, construction joints, forms, and embedded items shall be inspected by the Contractor in sufficient time prior to each concrete placement in order to certify to the Contracting Officer that they are ready to receive concrete. The results of each inspection shall be reported in writing.

#### 3.12.3 Placing

The placing foreman shall supervise placing operations, shall determine that the correct quality of concrete or grout is placed in each location as specified and as directed by the Contracting Officer, and shall be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, volume placed, and method of placement. The placing foreman shall not permit batching and placing to begin until it has been verified that an adequate number of vibrators in working order and with competent operators are available. Placing shall not be continued if any pile of concrete is inadequately consolidated. If any batch of concrete fails to meet the temperature requirements, immediate steps shall be taken to improve temperature controls.

#### 3.12.4 Curing Inspection

- a. Moist Curing Inspections. At least once each shift, and not less than twice per day on both work and non-work days, an inspection shall be made of all areas subject to moist curing. The surface moisture condition shall be noted and recorded.
- b. Moist Curing Corrective Action. When a daily inspection report lists an area of inadequate curing, immediate corrective action shall be taken, and the required curing period for those areas shall be extended by 1 day.
- c. Membrane Curing Inspection. No curing compound shall be applied until the Contractor has verified that the compound is properly mixed and ready for spraying. At the end of each operation, the Contractor shall estimate the quantity of compound used by measurement of the container and the area of concrete surface covered, shall compute the rate of coverage in square feet per gallon, and shall note whether or not coverage is uniform.
- d. Membrane Curing Corrective Action. When the coverage rate of the curing compound is less than that specified or when the coverage is not uniform, the entire surface shall be sprayed again.
- e. Sheet Curing Inspection. At least once each shift and once per

day on non-work days, an inspection shall be made of all areas being cured using impervious sheets. The condition of the covering and the tightness of the laps and tapes shall be noted and recorded.

- f. Sheet Curing Corrective Action. When a daily inspection report lists any tears, holes, or laps or joints that are not completely closed, the tears and holes shall promptly be repaired or the sheets replaced, the joints closed, and the required curing period for those areas shall be extended by 1 day.

#### 3.12.5 Cold-Weather Protection

At least once each shift and once per day on non-work days, an inspection shall be made of all areas subject to cold-weather protection. Any deficiencies shall be noted, corrected, and reported.

#### 3.12.6 Reports

All results of tests or inspections conducted shall be reported informally as they are completed and in writing daily. A weekly report shall be prepared for the updating of control charts covering the entire period from the start of the construction season through the current week. During periods of cold-weather protection, reports of pertinent temperatures shall be made daily. These requirements do not relieve the Contractor of the obligation to report certain failures immediately as required in preceding paragraphs. Such reports of failures and the action taken shall be confirmed in writing in the routine reports. The Contracting Officer has the right to examine all contractor quality control records.

-- End of Section --

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SECTION 04200A

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10/01

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## SECTION 04200A

MASONRY  
10/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 82	(1997a) Steel Wire, Plain, for Concrete Reinforcement
ASTM A 153/A 153M	(2000) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 615/A 615M	(2000) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C 55	(1999) Concrete Brick
ASTM C 67	(2000) Sampling and Testing Brick and Structural Clay Tile
ASTM C 90	(2000) Loadbearing Concrete Masonry Units
ASTM C 91	(1999) Masonry Cement
ASTM C 140	(1999b) Sampling and Testing Concrete Masonry Units
ASTM C 270	(2000) Mortar for Unit Masonry
ASTM C 476	(1999) Grout for Masonry
ASTM C 494/C 494M	(1999a) Chemical Admixtures for Concrete
ASTM C 641	(1982; R 1998e1) Staining Materials in Lightweight Concrete Aggregates
ASTM C 744	(1999) Prefaced Concrete and Calcium Silicate Masonry Units
ASTM C 780	(2000) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM C 1019	(2000) Sampling and Testing Grout
ASTM C 1072	(2000) Measurement of Masonry Flexural Bond Strength

ASTM D 2000	(1999) Rubber Products in Automotive Applications
ASTM D 2240	(2000) Rubber Property - Durometer Hardness
ASTM D 2287	(1996a) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

#### Masonry Work; G-DO

Drawings including plans, elevations, and details of wall reinforcement; details of reinforcing bars at corners and wall intersections; offsets; tops, bottoms, and ends of walls; control and expansion joints; and wall openings. Bar splice locations shall be shown. Bent bars shall be identified on a bending diagram and shall be referenced and located on the drawings. Wall dimensions, bar clearances, and wall openings greater than one masonry unit in area shall be shown. The minimum scale for wall elevations shall be 1/4 inch per foot.

### SD-03 Product Data

#### Cultured Stone; G-DO

#### Insulation; G-DO

Manufacturer's descriptive data.

#### Cold Weather Installation; G-AO

Cold weather construction procedures.

### SD-06 Test Reports

#### Efflorescence Test; G-AO

#### Field Testing of Mortar; G-AO

#### Field Testing of Grout; G-AO

#### Prism tests; G-AO

#### Masonry Cement; G-AO

#### Fire-rated CMU; G-AO

Test reports from an approved independent laboratory. Test reports on a previously tested material shall be certified as the same as that proposed for use in this project.

### SD-07 Certificates

#### Control Joint Keys;

Anchors, Ties, and Bar Positioners;  
Expansion-Joint Materials;  
Joint Reinforcement;  
Reinforcing Steel Bars and Rods;  
Masonry Cement;  
Precast Concrete Items;  
Mortar Admixtures;  
Grout Admixtures;

Cultured Stone Installation;

Certification by the Contractor that all installation procedures were followed in accordance with manufacturer's instructions.

#### SD-14 Samples

Samples; G-DO

Representative samples of cultured stone showing a full range of colors, rock shapes and mortar.

Representative samples of precast concrete unit.

### 1.3 DELIVERY, HANDLING, AND STORAGE

Materials shall be delivered, handled, stored, and protected to avoid chipping, breakage, and contact with soil or contaminating material.

#### 1.3.1 Masonry Units

Concrete masonry units shall be covered or protected from inclement weather.

#### 1.3.2 Reinforcement, Anchors, and Ties

Steel reinforcing bars, coated anchors, ties, and joint reinforcement shall be stored above the ground. Steel reinforcing bars and uncoated ties shall be free of loose mill scale and rust.

#### 1.3.3 Cementitious Materials, Sand and Aggregates

Cementitious and other packaged materials shall be delivered in unopened containers, plainly marked and labeled with manufacturers' names and brands. Cementitious material shall be stored in dry, weathertight enclosures or be completely covered. Cement shall be handled in a manner that will prevent the inclusion of foreign materials and damage by water or dampness. Sand and aggregates shall be stored in a manner to prevent contamination or segregation.

## PART 2 PRODUCTS

### 2.1 GENERAL REQUIREMENTS

The source of materials which will affect the appearance of the finished work shall not be changed after the work has started except with Contracting Officer's approval.

### 2.2 CULTURED STONE

Cultured stone shall be manufactured standard product from a supplier

regularly engaged in the production of units which replicate natural stone.

Stones shall be a blend of Portland cement, lightweight aggregates and iron oxide pigments. Cultured stone pattern and color shall be Stream Stone- Summer Standard (CSV-2071), random shapes, sizes, and colors. Stones shall vary in size from 1 1/4" to 6" high, shall vary in length from 2" to 12", and shall vary in thickness up to 3 1/2" thick. Stream Stone type shall be as manufactured by Cultured Stone, [www.culturedstone.com](http://www.culturedstone.com) (1-800-225-7462) or equal. Stone color shall be an integral part of the stone during casting. The product shall have a UL rating of zero flame spread and smoke development. Sizes shall vary in accordance with manufacturer's standard mix. Uniform size stones, visually obvious repetitive patterns, or exposed cut stone surfaces will not be acceptable. Type N mortar and application materials shall be as required by the manufacturer for application to plywood substraat. The entire installation system and associated materials shall be in accordance with the stone manufacturer standard system. This includes but is not limited to moisture barriers, metal lath, mortar, and mortar joint material. Manufacturer of the stone shall warrant the products against cracking, color change, and durability for a period of 50 years from Date of Substantial Completion. Warranty shall be signed by manufacturer.

### 2.3 CONCRETE BRICK

Concrete brick shall conform to ASTM C 55, Type I, Grade N-I. Concrete brick may be used where necessary for filling out in concrete masonry unit construction.

### 2.4 CONCRETE MASONRY UNITS (CMU)

Hollow and solid concrete masonry units shall conform to ASTM C 90. Cement shall have a low alkali content and be of one brand.

#### 2.4.1 Aggregates

Aggregates in proportions used in producing the units, shall comply with the following requirements when tested for stain-producing iron compounds in accordance with ASTM C 641: by visual classification method, the iron stain deposited on the filter paper shall not exceed the "light stain" classification.

#### 2.4.2 Kinds and Shapes

Units shall be modular in size and shall include closer, jamb, header, lintel, and bond beam units and special shapes and sizes to complete the work as indicated. In exposed interior masonry surfaces, units having a bullnose shall be used for vertical external corners except at door, window, and louver jambs. Radius of the bullnose shall be 1 inch. Units used in exposed masonry surfaces in any one building shall have a uniform fine to medium texture and a uniform color.

#### 2.4.3 Fire-Rated CMU

Concrete masonry units used in fire-rated construction shown on the drawings shall be of minimum equivalent thickness for the fire rating indicated and the corresponding type of aggregates indicated in TABLE I. Units containing more than one of the aggregates listed in TABLE I will be rated on the aggregate requiring the greater minimum equivalent thickness to produce the required fire rating.

TABLE I

## FIRE-RATED CONCRETE MASONRY UNITS

See note (a) below

Aggregate Type	Minimum equivalent thickness inches for fire rating of:		
	4 hours	3 hours	2 hours
Pumice	4.7	4.0	3.0
Expanded slag	5.0	4.2	3.3
Expanded clay, shale, or slate	5.7	4.8	3.7
Limestone, scoria, cinders or unexpanded slag	5.9	5.0	4.0
Calcareous gravel	6.2	5.3	4.2
Siliceous gravel	6.7	5.7	4.5

(a) Minimum equivalent thickness shall equal net volume as determined in conformance with ASTM C 140 divided by the product of the actual length and height of the face shell of the unit in inches.

## 2.5 PREFACED CONCRETE MASONRY UNITS

Prefaced concrete masonry units shall conform to ASTM C 744 using masonry units conforming to ASTM C 90. The facing shall turn over the edges and ends of the unit at least 3/8 inch in the direction of the thickness of the unit to form a lip at least 1/16 inch thick. Variation in color and texture shall not exceed that of the approved samples. All shapes and sizes shall be provided for a complete installation. Bullnose units shall be used along sills and caps and at vertical external corners including door jambs, window jambs, and other such openings. Radius of the bullnose shall be 1 inch.

## 2.6 PRECAST CONCRETE ITEMS

Trim, splashblocks and sills shall be factory-made units from a plant regularly engaged in producing precast concrete units. Unless otherwise indicated, concrete shall be 4,000 psi minimum conforming to Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE using 1/2 inch to No. 4 nominal-size coarse aggregate, and minimum reinforcement shall be the reinforcement required for handling of the units. Precast concrete units shall have an acid etch finish and an integral concrete mix to match the color requirements specified in Section 09915. Utilization of stones, aggregate, and portland cement mixes, which don't achieve the desired color will be considered unacceptable. Clearance of 3/4 inch shall be maintained between reinforcement and faces of units. Unless precast-concrete items have been subjected during manufacture to saturated-steam pressure of at least 120 psi for at least 5 hours, the items, after casting, shall be either damp-cured for 24 hours or steam-cured and shall then be aged under cover for 28 days

or longer. Cast-concrete members weighing over 80 pounds shall have built-in loops of galvanized wire or other approved provisions for lifting and anchoring. Units shall have beds and joints at right angles to the face, with sharp true arises and shall be cast with drip grooves on the underside where units overhang walls. Exposed-to-view surfaces shall be free of surface voids, spalls, cracks, and chipped or broken edges. Precast units exposed-to-view shall be of uniform appearance and color. Unless otherwise specified, units shall have a smooth dense finish. Prior to use, each item shall be wetted and inspected for crazing. Items showing evidence of dusting, spalling, crazing, or having surfaces treated with a protective coating will be rejected.

#### 2.6.1 Sills and Copings

Sills and copings shall be cast with washes. Sills for windows having mullions shall be cast in sections with head joints at mullions and a 1/4 inch allowance for mortar joints. The ends of sills, except a 3/4 inch wide margin at exposed surfaces, shall be roughened for bond. Treads of door sills shall have rounded nosings.

#### 2.6.2 Splash Blocks

Splash blocks shall be as detailed. Reinforcement shall be the manufacturer's standard.

### 2.7 MORTAR

Mortar shall be Type S in accordance with the proportion specification of ASTM C 270 except Type S cement-lime mortar proportions shall be 1 part cement, 1/2 part lime and 4-1/2 parts aggregate; when masonry cement ASTM C 91 is used the maximum air content shall be limited to 12 percent and performance equal to cement-lime mortar shall be verified. Verification of masonry cement performance shall be based on ASTM C 780 and ASTM C 1072. Cement shall have a low alkali content and be of one brand. Aggregates shall be from one source.

#### 2.7.1 Admixtures

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixture shall be non-corrosive, shall contain less than 0.2 percent chlorides, and shall conform to ASTM C 494/C 494M, Type C.

### 2.8 GROUT

Grout shall conform to ASTM C 476. Cement used in grout shall have a low alkali content. Grout slump shall be between 8 and 10 inches. Grout shall be used subject to the limitations of Table III. Proportions shall not be changed and materials with different physical or chemical characteristics shall not be used in grout for the work unless additional evidence is furnished that the grout meets the specified requirements.

#### 2.8.1 Admixtures

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixture shall be non-corrosive, shall contain less than 0.2 percent chlorides, and shall conform to ASTM C 494/C 494M, Type C.

### 2.8.2 Grout Barriers

Grout barriers for vertical cores shall consist of fine mesh wire, fiberglass, or expanded metal.

## 2.9 ANCHORS, TIES, AND BAR POSITIONERS

Anchors and ties shall be fabricated without drips or crimps and shall be zinc-coated in accordance with ASTM A 153/A 153M, Class B-2. Steel wire used for anchors and ties shall be fabricated from steel wire conforming to ASTM A 82. Anchors and ties shall be sized to provide a minimum of 5/8 inch mortar cover from either face.

### 2.9.1 Wire Mesh Ties

Wire mesh for tying 4 inch thick concrete masonry unit partitions to other intersecting masonry partitions shall be 1/2 inch mesh of minimum 16 gauge steel wire. Minimum lengths shall be not less than 12 inches.

### 2.9.2 Wall Ties

Wall ties shall be rectangular-shaped or Z-shaped fabricated of 3/16 inch diameter zinc-coated steel wire. Rectangular wall ties shall be no less than 4 inches wide. Wall ties may also be of a continuous type conforming to paragraph JOINT REINFORCEMENT. Adjustable type wall ties, if approved for use, shall consist of two essentially U-shaped elements fabricated of 3/16 inch diameter zinc-coated steel wire. Adjustable ties shall be of the double pintle to eye type and shall allow a maximum of 1/2 inch eccentricity between each element of the tie. Play between pintle and eye opening shall be not more than 1/16 inch. The pintle and eye elements shall be formed so that both can be in the same plane.

### 2.9.3 Bar Positioners

Bar positioners, used to prevent displacement of reinforcing bars during the course of construction, shall be factory fabricated from 9 gauge steel wire or equivalent, and coated with a hot-dip galvanized finish. Not more than one wire shall cross the cell.

## 2.10 JOINT REINFORCEMENT

Joint reinforcement shall be factory fabricated from steel wire conforming to ASTM A 82, welded construction. Tack welding will not be acceptable in reinforcement used for wall ties. Wire shall have zinc coating conforming to ASTM A 153/A 153M, Class B-2. All wires shall be a minimum of 9 gauge.

Reinforcement shall be ladder type design, having one longitudinal wire in the mortar bed of each face shell for hollow units and one wire for solid units. Joint reinforcement shall be placed a minimum of 5/8 inch cover from either face. The distance between cross wires shall not exceed 16 inches. Joint reinforcement for straight runs shall be furnished in flat sections not less than 10 feet long. Joint reinforcement shall be provided with factory formed corners and intersections. If approved for use, joint reinforcement may be furnished with adjustable wall tie features.

## 2.11 REINFORCING STEEL BARS AND RODS

Reinforcing steel bars and rods shall conform to ASTM A 615/A 615M, Grade 60.

## 2.12 CONTROL JOINT KEYS

Control joint keys shall be a factory fabricated solid section of natural or synthetic rubber (or combination thereof) conforming to ASTM D 2000 or polyvinyl chloride conforming to ASTM D 2287. The material shall be resistant to oils and solvents. The control joint key shall be provided with a solid shear section not less than 5/8 inch thick and 3/8 inch thick flanges, with a tolerance of plus or minus 1/16 inch. The control joint key shall fit neatly, but without forcing, in masonry unit jamb sash grooves. The control joint key shall be flexible at a temperature of minus 30 degrees F after five hours exposure, and shall have a durometer hardness of not less than 70 when tested in accordance with ASTM D 2240.

## 2.13 EXPANSION-JOINT MATERIALS

Backer rod and sealant shall be adequate to accommodate joint compression equal to 50 percent of the width of the joint. The backer rod shall be compressible rod stock of polyethylene foam, polyurethane foam, butyl rubber foam, or other flexible, nonabsorptive material as recommended by the sealant manufacturer. Sealant shall conform to Section 07900AJOINT SEALING.

## PART 3 EXECUTION

### 3.1 ENVIRONMENTAL REQUIREMENTS

#### 3.1.1 Hot Weather Installation

The following precautions shall be taken if masonry is erected when the ambient air temperature is more than 99 degrees F in the shade and the relative humidity is less than 50 percent. All masonry materials shall be shaded from direct sunlight; mortar beds shall be spread no more than 4 feet ahead of masonry; masonry units shall be set within one minute of spreading mortar; and after erection, masonry shall be protected from direct exposure to wind and sun for 48 hours.

#### 3.1.2 Cold Weather Installation

Before erecting masonry when ambient temperature or mean daily air temperature falls below 40 degrees F, a written statement of proposed cold weather construction procedures shall be submitted for approval. The following precautions shall be taken during all cold weather erection.

##### 3.1.2.1 Preparation

Ice or snow formed on the masonry bed shall be thawed by the application of heat. Heat shall be applied carefully until the top surface of the masonry is dry to the touch. Sections of masonry deemed frozen and damaged shall be removed before continuing construction of those sections.

- a. Air Temperature 40 to 32 Degrees F. Sand or mixing water shall be heated to produce mortar temperatures between 40 and 120 degrees F.
- b. Air Temperature 32 to 25 Degrees F. Sand and mixing water shall be heated to produce mortar temperatures between 40 and 120 degrees F. Temperature of mortar on boards shall be maintained above freezing.
- c. Air Temperature 25 to 20 Degrees F. Sand and mixing water shall

be heated to provide mortar temperatures between 40 and 120 degrees F. Temperature of mortar on boards shall be maintained above freezing. Sources of heat shall be used on both sides of walls under construction. Windbreaks shall be employed when wind is in excess of 15 mph.

- d. Air Temperature 20 Degrees F and below. Sand and mixing water shall be heated to provide mortar temperatures between 40 and 120 degrees F. Enclosure and auxiliary heat shall be provided to maintain air temperature above 32 degrees F. Temperature of units when laid shall not be less than 20 degrees F.

#### 3.1.2.2 Completed Masonry and Masonry Not Being Worked On

- a. Mean daily air temperature 40 to 32 degrees F. Masonry shall be protected from rain or snow for 24 hours by covering with weather-resistive membrane.
- b. Mean daily air temperature 32 to 25 degrees F. Masonry shall be completely covered with weather-resistant membrane for 24 hours.
- c. Mean Daily Air Temperature 25 to 20 degrees F. Masonry shall be completely covered with insulating blankets or equally protected for 24 hours.
- d. Mean Daily Temperature 20 degrees F and Below. Masonry temperature shall be maintained above 32 degrees F for 24 hours by enclosure and supplementary heat, by electric heating blankets, infrared heat lamps, or other approved methods.

### 3.2 LAYING MASONRY UNITS

Masonry units shall be laid in running bond pattern. Facing courses shall be level with back-up courses, unless the use of adjustable ties has been approved in which case the tolerances shall be plus or minus 1/2 inch. Each unit shall be adjusted to its final position while mortar is still soft and plastic. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned, and relaid with fresh mortar. Expansion joints, and spaces to be grouted shall be kept free from mortar and other debris. Units used in exposed masonry surfaces shall be selected from those having the least amount of chipped edges or other imperfections detracting from the appearance of the finished work. Vertical joints shall be kept plumb. Units being laid and surfaces to receive units shall be free of water film and frost. Solid units shall be laid in a nonfurrowed full bed of mortar. Units shall be shoved into place so that the vertical joints are tight. Vertical joints and the vertical face shells of concrete masonry units, except where indicated at control and expansion joints, shall be completely filled with mortar. Mortar will be permitted to protrude up to 1/2 inch into the space or cells to be grouted. Means shall be provided to prevent mortar from dropping into the space below.

#### 3.2.1 Surface Preparation

Surfaces upon which masonry is placed shall be cleaned of laitance, dust, dirt, oil, organic matter, or other foreign materials and shall be slightly roughened to provide a surface texture with a depth of at least 1/8 inch. Sandblasting shall be used, if necessary, to remove laitance from pores and to expose the aggregate.

### 3.2.2 Shoring of lintels

Shores shall be sufficiently rigid to prevent deflections which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout. Supporting forms and shores shall not be removed in less than 10 days.

### 3.2.3 Concrete Masonry Units

Starting courses on footings, solid foundation walls, lintels, and where cells are to be filled with grout shall be full bedded in mortar under both face shells and webs. Other units shall be full bedded under both face shells. Head joints shall be filled solidly with mortar for a distance in from the face of the unit not less than the thickness of the face shell. Foundation walls below grade shall be grouted solid. Jamb units shall be of the shapes and sizes to conform with wall units. Solid units may be incorporated in the masonry work where necessary to fill out at corners and elsewhere as approved. Walls and partitions shall be adequately reinforced for support of wall-hung plumbing fixtures when chair carriers are not specified.

### 3.2.4 Clay or Shale Brick Units

Brick facing shall be laid with the better face exposed. Brick shall be laid in running bond with each course bonded at corners, unless otherwise indicated. Molded brick shall be laid with the frog side down. Brick that is cored, recessed, or has other deformations may be used in sills, treads, soldier courses, except where deformations will be exposed to view.

#### 3.2.4.1 Wetting of Units

Wetting of clay, shale brick, or hollow brick units having an initial rate of absorption of more than 1 gram per minute per square inch of bed surface shall be in conformance with ASTM C 67. The method of wetting shall ensure that each unit is nearly saturated but surface dry when laid.

#### 3.2.4.2 Solid Units

Bed, head, and collar joints shall be completely filled with mortar.

#### 3.2.4.3 Hollow Units

Hollow units shall be laid as specified for concrete masonry units.

### 3.2.5 Tolerances

Masonry shall be laid plumb, true to line, with courses level. Bond pattern shall be kept plumb throughout. Corners shall be square unless noted otherwise. Except for walls constructed of prefaced concrete masonry units, masonry shall be laid within the following tolerances (plus or minus unless otherwise noted):

#### TABLE II

#### TOLERANCES

Variation from the plumb in the lines  
and surfaces of columns, walls and arises

---

## TOLERANCES

In adjacent masonry units	1/8 inch
In 10 feet	1/4 inch
In 20 feet	3/8 inch
In 40 feet or more	1/2 inch

Variations from the plumb for external corners, expansion joints, and other conspicuous lines

---

In 20 feet	1/4 inch
In 40 feet or more	1/2 inch

Variations from the level for exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines

---

In 20 feet	1/4 inch
In 40 feet or more	1/2 inch

Variation from level for bed joints and top surfaces of bearing walls

---

In 10 feet	1/4 inch
In 40 feet or more	1/2 inch

Variations from horizontal lines

---

In 10 feet	1/4 inch
In 20 feet	3/8 inch
In 40 feet or more	1/2 inch

Variations in cross sectional dimensions of columns and in thickness of walls

---

Minus	1/4 inch
Plus	1/2 inch

## 3.2.6 Cutting and Fitting

Full units of the proper size shall be used wherever possible, in lieu of cut units. Cutting and fitting, including that required to accommodate the work of others, shall be done by masonry mechanics using power masonry saws. Concrete masonry units may be wet or dry cut. Wet cut units, before being placed in the work, shall be dried to the same surface-dry appearance as uncut units being laid in the wall. Cut edges shall be clean, true and sharp. Openings in the masonry shall be made carefully so that wall plates, cover plates or escutcheons required by the installation will completely conceal the openings and will have bottoms parallel with the masonry bed joints. Reinforced masonry lintels shall be provided above openings over 12 inches wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.

### 3.2.7 Jointing

Joints shall be tooled when the mortar is thumbprint hard. Horizontal joints shall be tooled last. Joints shall be brushed to remove all loose and excess mortar. Mortar joints shall be finished as follows:

#### 3.2.7.1 Flush Joints

Joints in concealed masonry surfaces and joints at electrical outlet boxes in wet areas shall be flush cut. Flush cut joints shall be made by cutting off the mortar flush with the face of the wall. Joints in unparged masonry walls below grade shall be pointed tight. Flush joints for architectural units, such as fluted units, shall completely fill both the head and bed joints.

#### 3.2.7.2 Tooled Joints

Joints in exposed masonry surfaces shall be tooled slightly concave. Joints shall be tooled with a jointer slightly larger than the joint width so that complete contact is made along the edges of the unit. Tooling shall be performed so that the mortar is compressed and the joint surface is sealed. Jointer of sufficient length shall be used to obtain a straight and true mortar joint.

#### 3.2.7.3 Door and Window Frame Joints

On the exposed interior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch. On the exterior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch.

### 3.2.8 Joint Widths

Concrete masonry units shall have 3/8 inch joints.

#### 3.2.8.1 Prefaced Concrete Masonry Units

Prefaced concrete masonry units shall have a joint width of 3/8 inch wide on unfaced side and not less than 3/16 inch nor more than 1/4 inch wide on prefaced side.

#### 3.2.8.2 Brick

Brick joint widths shall be the difference between the actual and nominal dimensions of the brick in either height or length. Brick expansion joint widths shall be as shown.

#### 3.2.9 Embedded Items

Spaces around built-in items shall be filled with mortar. Openings around flush-mount electrical outlet boxes in wet locations shall be pointed with mortar. Anchors, ties, wall plugs, accessories, flashing, pipe sleeves and other items required to be built-in shall be embedded as the masonry work progresses. Anchors, ties and joint reinforcement shall be fully embedded in the mortar. Cells receiving anchor bolts and cells of the first course below bearing plates shall be filled with grout.

#### 3.2.10 Unfinished Work

Unfinished work shall be stepped back for joining with new work. Tothing may be resorted to only when specifically approved. Loose mortar shall be removed and the exposed joints shall be thoroughly cleaned before laying new work.

### 3.2.11 Masonry Wall Intersections

Each course shall be masonry bonded at corners and elsewhere as shown. Masonry walls shall be anchored or tied together at corners and intersections with bond beam reinforcement and prefabricated corner or tee pieces of joint reinforcement as shown.

### 3.2.12 Partitions

Partitions shall have vertical reinforcement continuous from footings to top elevation shown on drawings where top of partition braced by steel framing to roof, and horizontal bond beams and reinforcement around openings as shown on the drawings. Interior partitions shall be tied together with joint reinforcement. Partitions containing joint reinforcement shall be provided with prefabricated pieces at corners and intersections or partitions.

## 3.3 SETTING CULTURED STONE

Set cultured stone in an uncoursed, random pattern matching the approved sample panels, with stones pitched downward wherever possible to weather. Cultured stone shall be set in accordance with manufacturer's installation instructions. Exposed cut stone surfaces will not be acceptable and will require approval of Contracting Officer for limited application. Cutting or trimming of stone shall be in accordance with the manufacturer's recommendations. Set stones before initial set of mortar bed occurs. Do not set stone on a dry bed. Wet stones which are dry at time of setting by drenching or sponging with water or as required by the manufacturer. Tamp or beat stones with a nonmetallic mallet or similar tool, to obtain full contact and adhesion with setting bed. Set and level each stone immediately, prior to initial set of mortar. Do not attempt to level stones which have reached initial set. Place setting buttons of adequate size, in sufficient quantity, and of same thickness as indicated joint width, to prevent mortar from squeezing out and to maintain joint widths. Do not set heavy stones or projecting courses until mortar in courses below has hardened sufficiently to resist being squeezed out of joint. Support projecting stones by props or anchors until wall above is set. Fill mortar joints as soon as possible after initial set of setting bed. Force mortar into joints and tool to slightly concave profile. Exercise care to prevent mortar smears on exposed stone surfaces. All joints between the stones shall be filled solid with mortar to approximately 3/4 to 1 inch from the exterior face of stone. Actual mortar depth shall be in accordance with the approved sample. After mortar has set, all joints shall be cleaned in accordance with the manufacturer. Open joints, other than sealed joints, shall be wetted and filled with pointing mortar. Pointing mortar shall be compressed with a tool and rubbed smooth to the section shown. Cure mortar in accordance with the stone manufacturer. Submit proposal in shop drawing for method of constructing fire place mantel support at stone ledgers.

### 3.3.1 Stone Anchorage

Anchorage to plywood substraat shall be in accordance with manufacturer's recommendations. A moisture resistance barrier shall be laid directly over the plywood substraat. A galvanized mesh shall be securely anchored over

the moisture barrier. Do not use metal mesh having loose rust and other coatings, including ice, which will reduce or destroy bond or harm stone appearance due to corrosion. A Type N mortar bed shall be laid for the stone installation. After the stone installation, a Type N mortar shall be applied to fill all stone joints to approximately 3/4 to 1 inch from the exterior face of the stone.

### 3.3.2 Adjusting and Cleaning

Remove and replace stone units which are loose, chipped, broken, stained or otherwise damaged. Provide new units and install in fresh mortar, pointed to eliminate evidence of replacement. During the tooling of joints, enlarge voids and holes and completely fill with mortar. Point-up joints at corners, openings and adjacent work to provide a neat, uniform appearance, properly prepared for installation application of sealant compounds. During the progress of work, wipe off excess mortar as the work progresses. Dry brush at the end of each day's work. After mortar is thoroughly set and cured, dry clean to remove large particles of mortar using wood paddles and scrapers. Do not use wire brushes, acid washes or high pressure water washes. Verify cleaning procedure with cultured stone supplier and mortar manufacturers before any cleaning. Contractor shall provide protective measures to prevent efflorescence as a result of water penetration into the masonry during construction. Cleaning of efflorescence shall be in accordance with the stone manufacturer.

### 3.4 PREFACED CONCRETE MASONRY UNITS

Prefaced concrete masonry units shall be installed as specified for concrete masonry units and as required herein. Single-faced units may be installed through the wall where walls or partitions are indicated to have structural clay facing unit finish on one side only. The facing shall be used for dimensional and plane reference in the installation. Two-faced walls or partitions shall consist of two units bonded and tied together as specified for composite walls. Wainscots shall be of full courses to approximate as nearly as possible the height indicated, except that in no case shall the wainscots be lower than 2 inches below the specified height.

Units shall be set level and true so that bases and walls will present true planes and surfaces free of waviness, offset, or other distortion. Joint reinforcing shall be placed not over 16 inches on center vertically.

### 3.5 MORTAR

Mortar shall be mixed in a mechanically operated mortar mixer for at least 3 minutes, but not more than 5 minutes. Measurement of ingredients for mortar shall be by volume. Ingredients not in containers, such as sand, shall be accurately measured by the use of measuring boxes. Water shall be mixed with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of masonry units. Mortar that has stiffened because of loss of water through evaporation shall be retempered by adding water to restore the proper consistency and workability. Mortar that has reached its initial set or that has not been used within 2-1/2 hours after mixing shall be discarded.

### 3.6 REINFORCING STEEL

Reinforcement shall be cleaned of loose, flaky rust, scale, grease, mortar, grout, or other coating which might destroy or reduce its bond prior to placing grout. Bars with kinks or bends not shown on the drawings shall not be used. Reinforcement shall be placed prior to grouting. Unless

otherwise indicated, vertical wall reinforcement shall extend to within 2 inches of tops of walls.

### 3.6.1 Positioning Bars

Vertical bars shall be accurately placed within the cells at the positions indicated on the drawings. A minimum clearance of 1/2 inch shall be maintained between the bars and masonry units. Minimum clearance between parallel bars shall be one diameter of the reinforcement. Vertical reinforcing may be held in place using bar positioners located near the ends of each bar and at intermediate intervals of not more than 192 diameters of the reinforcement. Column and pilaster ties shall be wired in position around the vertical steel. Ties shall be in contact with the vertical reinforcement and shall not be placed in horizontal bed joints.

### 3.6.2 Splices

Bars shall be lapped a minimum of 48 diameters of the reinforcement. Welded or mechanical connections shall develop at least 125 percent of the specified yield strength of the reinforcement.

## 3.7 JOINT REINFORCEMENT

Joint reinforcement shall be installed at 16 inches on center or as indicated. Reinforcement shall be lapped not less than 6 inches. Prefabricated sections shall be installed at corners and wall intersections. The longitudinal wires of joint reinforcement shall be placed to provide not less than 5/8 inch cover to either face of the unit.

## 3.8 PLACING GROUT

Cells containing reinforcing bars shall be filled with grout. Hollow masonry units in walls or partitions supporting plumbing, heating, or other mechanical fixtures, voids at door and window jambs, and other indicated spaces shall be filled solid with grout. Cells under lintel bearings on each side of openings shall be filled solid with grout for full height of openings. Walls below grade, lintels, and bond beams shall be filled solid with grout. Units other than open end units may require grouting each course to preclude voids in the units. Grout not in place within 1-1/2 hours after water is first added to the batch shall be discarded. Sufficient time shall be allowed between grout lifts to preclude displacement or cracking of face shells of masonry units. If blowouts, flowouts, misalignment, or cracking of face shells should occur during construction, the wall shall be torn down and rebuilt.

### 3.8.1 Horizontal Grout Barriers

Grout barriers shall be embedded in mortar below cells of hollow units receiving grout.

### 3.8.2 Grout Holes and Cleanouts

#### 3.8.2.1 Grout Holes

Grouting holes shall be provided in slabs, spandrel beams, and other in-place overhead construction. Holes shall be located over vertical reinforcing bars or as required to facilitate grout fill in bond beams. Additional openings spaced not more than 16 inches on centers shall be provided where grouting of all hollow unit masonry is indicated. Openings

shall not be less than 4 inches in diameter or 3 by 4 inches in horizontal dimensions. Upon completion of grouting operations, grouting holes shall be plugged and finished to match surrounding surfaces.

#### 3.8.2.2 Cleanouts for Hollow Unit Masonry Construction

Cleanout holes shall be provided at the bottom of every pour in cores containing vertical reinforcement when the height of the grout pour exceeds 5 feet. Where all cells are to be grouted, cleanout courses shall be constructed using bond beam units in an inverted position to permit cleaning of all cells. Cleanout holes shall be provided at a maximum spacing of 32 inches where all cells are to be filled with grout. A new series of cleanouts shall be established if grouting operations are stopped for more than 4 hours. Cleanouts shall not be less than 3 by 4 inch openings cut from one face shell. Manufacturer's standard cutout units may be used at the Contractor's option. Cleanout holes shall not be closed until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, cleanout holes shall be closed in an approved manner to match surrounding masonry.

#### 3.8.3 Grouting Equipment

##### 3.8.3.1 Grout Pumps

Pumping through aluminum tubes will not be permitted. Pumps shall be operated to produce a continuous stream of grout without air pockets, segregation, or contamination. Upon completion of each day's pumping, waste materials and debris shall be removed from the equipment, and disposed of outside the masonry.

##### 3.8.3.2 Vibrators

Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the grout. At least one spare vibrator shall be maintained at the site at all times. Vibrators shall be applied at uniformly spaced points not further apart than the visible effectiveness of the machine. Duration of vibration shall be limited to time necessary to produce satisfactory consolidation without causing segregation.

#### 3.8.4 Grout Placement

Masonry shall be laid to the top of a pour before placing grout. Grout shall not be placed in two-wythe solid unit masonry cavity until mortar joints have set for at least 3 days during hot weather and 5 days during cold damp weather. Grout shall not be placed in hollow unit masonry until mortar joints have set for at least 24 hours. Grout shall be placed using a hand bucket, concrete hopper, or grout pump to completely fill the grout spaces without segregation of the aggregates. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. The height of grout pours and type of grout used shall be limited by the dimensions of grout spaces as indicated in Table III. Low-lift grout methods may be used on pours up to and including 5 feet in height. High-lift grout methods shall be used on pours exceeding 5 feet in height.

##### 3.8.4.1 Low-Lift Method

Grout shall be placed at a rate that will not cause displacement of the masonry due to hydrostatic pressure of the grout. Mortar protruding more

than 1/2 inch into the grout space shall be removed before beginning the grouting operation. Grout pours 12 inches or less in height shall be consolidated by mechanical vibration or by puddling. Grout pours over 12 inches in height shall be consolidated by mechanical vibration and reconsolidated by mechanical vibration after initial water loss and settlement has occurred. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. Low-lift grout shall be used subject to the limitations of Table III.

#### 3.8.4.2 High-Lift Method

Mortar droppings shall be cleaned from the bottom of the grout space and from reinforcing steel. Mortar protruding more than 1/4 inch into the grout space shall be removed by dislodging the projections with a rod or stick as the work progresses. Reinforcing, bolts, and embedded connections shall be rigidly held in position before grouting is started. CMU units shall not be pre-wetted. Grout, from the mixer to the point of deposit in the grout space shall be placed as rapidly as practical by pumping and placing methods which will prevent segregation of the mix and cause a minimum of grout splatter on reinforcing and masonry surfaces not being immediately encased in the grout lift. The individual lifts of grout shall be limited to 4 feet in height. The first lift of grout shall be placed to a uniform height within the pour section and vibrated thoroughly to fill all voids. This first vibration shall follow immediately behind the pouring of the grout using an approved mechanical vibrator. After a waiting period sufficient to permit the grout to become plastic, but before it has taken any set, the succeeding lift shall be poured and vibrated 12 to 18 inches into the preceding lift. If the placing of the succeeding lift is going to be delayed beyond the period of workability of the preceding, each lift shall be reconsolidated by reworking with a second vibrator as soon as the grout has taken its settlement shrinkage. The waiting, pouring, and reconsolidation steps shall be repeated until the top of the pour is reached. The top lift shall be reconsolidated after the required waiting period. The high-lift grouting of any section of wall between vertical grout barriers shall be completed to the top of a pour in one working day unless a new series of cleanout holes is established and the resulting horizontal construction joint cleaned. High-lift grout shall be used subject to the limitations in Table III.

TABLE III

#### POUR HEIGHT AND TYPE OF GROUT FOR VARIOUS GROUT SPACE DIMENSIONS

Maximum Grout Pour Height (feet) (4)	Grout Type	Grouting Procedure	Minimum Dimensions of the Total Clear Areas Within Grout Spaces and Cells (in.) (1,2)	
			Multiwythe Masonry (3)	Hollow-unit Masonry
1	Fine	Low Lift	3/4	1-1/2 x 2
5	Fine	Low Lift	2	2 x 3
8	Fine	High Lift	2	2 x 3
12	Fine	High Lift	2-1/2	2-1/2 x 3
24	Fine	High Lift	3	3 x 3
1	Coarse	Low Lift	1-1/2	1-1/2 x 3
5	Coarse	Low Lift	2	2-1/2 x 3
8	Coarse	High Lift	2	3 x 3

TABLE III

## POUR HEIGHT AND TYPE OF GROUT FOR VARIOUS GROUT SPACE DIMENSIONS

Maximum Grout Pour Height (feet) (4)	Grout Type	Grouting Procedure	Minimum Dimensions of the Total Clear Areas Within Grout Spaces and Cells (in.) (1,2)	
			Multiwythe Masonry (3)	Hollow-unit Masonry
12	Coarse	High Lift	2-1/2	3 x 3
24	Coarse	High Lift	3	3 x 4

## Notes:

- (1) The actual grout space or cell dimension must be larger than the sum of the following items:
  - a) The required minimum dimensions of total clear areas given in the table above;
  - b) The width of any mortar projections within the space;
  - c) The horizontal projections of the diameters of the horizontal reinforcing bars within a cross section of the grout space or cell.
- (2) The minimum dimensions of the total clear areas shall be made up of one or more open areas, with at least one area being 3/4 inch or greater in width.
- (3) For grouting spaces between masonry wythes.
- (4) Where only cells of hollow masonry units containing reinforcement are grouted, the maximum height of the pour shall not exceed the distance between horizontal bond beams.

## 3.9 BOND BEAMS

Bond beams shall be filled with grout and reinforced as indicated on the drawings. Grout barriers shall be installed under bond beam units to retain the grout as required. Reinforcement shall be continuous, including around corners, except through control joints or expansion joints, unless otherwise indicated on the drawings. Where splices are required for continuity, reinforcement shall be lapped 48 bar diameters. A minimum clearance of 1/2 inch shall be maintained between reinforcement and interior faces of units.

## 3.10 CONTROL JOINTS

Control joints shall be provided as indicated and shall be constructed by using special control-joint units in accordance with the details shown on the drawings. Control joint units shall have a 3/4 by 3/4 inch groove near the center at end of each unit. The vertical mortar joint at control joint locations shall be continuous, including through all bond beams. This shall be accomplished by utilizing half blocks in alternating courses on each side of the joint. The control joint key shall be interrupted in courses containing continuous bond beam steel. Exposed interior control joints shall be raked to a depth of 1/4 inch. Concealed control joints shall be flush cut.

## 3.11 LINTELS

### 3.11.1 Masonry Lintels

Masonry lintels shall be constructed with lintel units filled solid with grout in all courses and reinforced as indicated on the drawings. Lintel reinforcement shall extend beyond each side of masonry opening 40 bar diameters or 24 inches, whichever is greater. Reinforcing bars shall be supported in place prior to grouting and shall be located 1/2 inch above the bottom inside surface of the lintel unit.

### 3.12 SILLS AND COPINGS

Sills and copings shall be set in a full bed of mortar with faces plumb and true.

### 3.13 SPLASH BLOCKS

Splash blocks shall be located as shown.

### 3.14 POINTING AND CLEANING

After mortar joints have attained their initial set, but prior to hardening, mortar and grout daubs or splashings shall be completely removed from masonry-unit surfaces that will be exposed or painted. Before completion of the work, defects in joints of masonry to be exposed or painted shall be raked out as necessary, filled with mortar, and tooled to match existing joints. Immediately after grout work is completed, scum and stains which have percolated through the masonry work shall be removed using a high pressure stream of water and a stiff bristled brush. Masonry surfaces shall not be cleaned, other than removing excess surface mortar, until mortar in joints has hardened. Masonry surfaces shall be left clean, free of mortar daubs, dirt, stain, and discoloration, including scum from cleaning operations, and with tight mortar joints throughout. Metal tools and metal brushes shall not be used for cleaning.

#### 3.14.1 Concrete Masonry Unit Concrete Brick Surfaces

Exposed concrete masonry unit concrete brick surfaces shall be dry-brushed at the end of each day's work and after any required pointing, using stiff-fiber bristled brushes.

#### 3.14.2 Clay or Shale Brick Surfaces

Exposed clay or shale brick masonry surfaces shall be cleaned as necessary to obtain surfaces free of stain, dirt, mortar and grout daubs, efflorescence, and discoloration or scum from cleaning operations. After cleaning, the sample panel of similar material shall be examined for discoloration or stain as a result of cleaning. If the sample panel is discolored or stained, the method of cleaning shall be changed to assure that the masonry surfaces in the structure will not be adversely affected. The exposed masonry surfaces shall be water-soaked and then cleaned with a solution proportioned 1/2 cup trisodium phosphate and 1/2 cup laundry detergent to one gallon of water or cleaned with a proprietary masonry cleaning agent specifically recommended for the color and texture by the clay products manufacturer. The solution shall be applied with stiff fiber brushes, followed immediately by thorough rinsing with clean water. Proprietary cleaning agents shall be used in conformance with the cleaning product manufacturer's printed recommendations. Efflorescence shall be removed in conformance with the brick manufacturer's recommendations.

### 3.14.3 Prefaced Concrete Masonry Unit Surfaces

Prefaced concrete masonry unit surfaces shall be cleaned with soap powder and clean water applied with stiff fiber brushes. Excess mortar shall be removed with wood paddles. Metal cleaning tools, metal brushes, abrasive powders, and acid solutions shall not be used. At the completion of cleaning operations, the surfaces shall be rinsed with clean water. In areas of traffic within the building, a barricade of wood supported by framing lumber shall be erected to protect the units. In other areas, a heavy kraft-type building paper shall be taped over the units until final acceptance.

### 3.15 BEARING PLATES

Bearing plates for beams and similar structural members shall be set to the proper line and elevation with damp-pack bedding mortar. Bedding mortar shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

### 3.16 PROTECTION

Facing materials shall be protected against staining. Top of walls shall be covered with nonstaining waterproof covering or membrane when work is not in progress. Covering of the top of the unfinished walls shall continue until the wall is waterproofed with a complete roof or parapet system. Covering shall extend a minimum of 2 feet down on each side of the wall and shall be held securely in place. Before starting or resuming, top surface of masonry in place shall be cleaned of loose mortar and foreign material.

### 3.17 TEST REPORTS

#### 3.17.1 Field Testing of Mortar

At least three specimens of mortar shall be taken each day. A layer of mortar 1/2 to 5/8 inch thick shall be spread on the masonry units and allowed to stand for one minute. The specimens shall then be prepared and tested for compressive strength in accordance with ASTM C 780.

#### 3.17.2 Field Testing of Grout

Field sampling and testing of grout shall be in accordance with the applicable provisions of ASTM C 1019. A minimum of three specimens of grout per day shall be sampled and tested. Each specimen shall have a minimum ultimate compressive strength of 2000 psi at 28 days.

#### 3.17.3 Efflorescence Test

Brick which will be exposed to weathering shall be tested for efflorescence. Tests shall be scheduled far enough in advance of starting masonry work to permit retesting if necessary. Sampling and testing shall conform to the applicable provisions of ASTM C 67. Units meeting the definition of "effloresced" will be subject to rejection.

-- End of Section --

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## SECTION 05093A

WELDING PRESSURE PIPING  
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## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ASNT RP SNT-TC-1A	(1996) Recommended Practice SNT-TC-1A
ASNT Q&A Bk A	(1996) Question and Answer Book A: Radiographic Test Method; Levels I, II, III (Supplement to Recommended Practice SNT-TC-1A)
ASNT RP SNT-TC-1A Bk B	(1994) Question and Answers Levels I, II, and III Magnetic Particle Method Book B (Supplement to RP SNT-TC-1A)
ASNT Q&A Bk C	(1994) Question and Answer Book C: Ultrasonic Testing Method; Levels I, II, III (Supplement to RP SNT-TC-1A)
ASNT Q&A Bk D	(1996) Question and Answer Book D: Liquid Penetrant Testing Method; Levels I, II, III (Supplement to RP SNT-TC-1A)

## ASME INTERNATIONAL (ASME)

ASME B31.3	(1999) Process Piping
ASME BPVC SEC I	(1998) Boiler and Pressure Vessel Code; Section I, Power Boilers
ASME BPVC SEC II-C	(1998) Boiler and Pressure Vessel Code; Section II, Materials, Part C - Specifications for Welding Rods, Electrodes and Filler Metals
ASME BPVC SEC V	(1998) Boiler and Pressure Vessel Code; Section V, Nondestructive Examination
ASME BPVC SEC IX	(1998) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

## AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(1998) Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS A3.0	(1994) Standard Welding Terms and Definitions
AWS B2.1	(1998) Welding Procedure and Performance Qualification
AWS QC1	(1996) AWS Certification of Welding Inspectors
AWS Z49.1	(1999) Safety in Welding and Cutting and Allied Processes

## 1.2 DEFINITIONS

Definitions shall be in accordance with AWS A3.0.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

## Pressure Piping; G-DO

Detail drawings showing location, length, and type of welds; and indicating postweld heat treatment and NDE as required.

## SD-03 Product Data

## Qualifications; G-AO

Welding procedure qualification.

## Welding Operations; G-AO

Detailed procedures which define methods of compliance to contract drawings and specifications. Inspection and material procurement records. System and material testing and certification records. Written records and drawings indicating location of welds made by each welder or welding operator.

## SD-07 Certificates

## Qualifications; G-AO

Welder and welding operator performance qualification certificates. Welding inspectors and NDE personnel certificates. Qualifications of testing laboratory or the Contractor's quality assurance organization.

#### 1.4 GENERAL REQUIREMENTS

This section covers the welding of all above-grade pressure piping systems within the hatchery building. Pressure piping shall be considered those pipes that operate under a minimum of 10 psi operating pressure during any operating condition. Deviations from applicable codes, approved procedures, and approved detail drawings will not be permitted without prior written approval. Materials or components with welds made offsite will not be accepted if the welding does not conform to the requirements of this specification, unless otherwise specified. Procedures shall be developed by the Contractor for welding all metals included in the work. Welding shall not be started until welding procedures, welders, and welding operators have been qualified. Qualification testing shall be performed by an approved testing laboratory, or by the Contractor if approved by the Contracting Officer. Costs of such testing shall be borne by the Contractor. The Contracting Officer shall be notified at least 24 hours in advance of the time and place of the tests. When practicable, the qualification tests shall be performed at or near the worksite. The Contractor shall maintain current records of the test results obtained in the welding procedure, welding operator, welder performance qualifications, and nondestructive examination (NDE) procedures readily available at the site for examination by the Contracting Officer. The procedures for making transition welds between different materials or between plates or pipes of different wall thicknesses shall be qualified. ASME B31.3 requirements for branch connections may be used in lieu of detailed designs. Unless otherwise specified, the choice of welding process shall be the responsibility of the Contractor.

#### 1.5 PERFORMANCE

The Contractor shall be responsible for the quality of all joint preparation, welding, and examination. All materials used in the welding operations shall be clearly identified and recorded. The inspection and testing defined in this specification are minimum requirements. Additional inspection and testing shall be the responsibility of the Contractor when he deems it necessary to achieve the quality required.

#### 1.6 QUALIFICATIONS

Welding procedures, welders, and welding operators previously qualified by test may be accepted for the work without requalification, provided that all of the following conditions are fulfilled:

- a. Copies of the welding procedures, the procedure qualification test records, and the welder and welding operator performance qualification test records are submitted and approved in accordance with paragraph SUBMITTALS.
- b. Testing was performed by an approved testing laboratory or technical consultant or by the Contractor's approved quality assurance organization.
- c. The welding procedures, welders, and welding operators were qualified in accordance with ASME BPVC SEC IX, or AWS B2.1, AR-2 level; and base materials, filler materials, electrodes, equipment, and processes conformed to the applicable requirements of this specification.
- d. The requirements of paragraph "Renewal of Qualification" below are

met and records showing name of employer and period of employment using the process for which qualified are submitted as evidence of conformance.

#### 1.6.1 Welding Procedures Qualification

The Contractor shall record in detail and shall qualify the Welding Procedure Specifications for every proposed welding procedure. Qualification for each welding procedure shall conform to the requirements of ASME B31.3 and to this specification. The welding procedures shall specify end preparation for butt welds including cleaning, alignment, and root openings. Preheat, interpass temperature control, and postheat treatment of welds shall be as required by approved welding procedures, unless otherwise indicated or specified. The type of backing rings or consumable inserts, if used, shall be described and if they are to be removed, the removal process shall be described. Copies of the welding procedure specifications and procedure qualification test results for each type of welding required shall be submitted in accordance with paragraph SUBMITTALS. Approval of any procedure does not relieve the Contractor of the sole responsibility for producing acceptable welds. Welding procedures shall be identified individually and shall be referenced on the detail drawings or keyed to the contract drawings.

#### 1.6.2 Welder and Welding Operator Performance

Each welder and welding operator assigned to work shall be qualified in accordance with ASME B31.3.

##### 1.6.2.1 Certification

Before assigning welders or welding operators to the work, the Contractor shall provide the Contracting Officer with their names together with certification that each individual is performance-qualified as specified. The certification shall state the type of welding and positions for which each is qualified, the code and procedure under which each is qualified, date qualified, and the firm and individual certifying the qualification tests.

##### 1.6.2.2 Identification

Each particular weld shall be identified with the personal number, letter, or symbol assigned to each welder or welding operator. To identify welds, written records indicating the location of welds made by each welder or welding operator shall be submitted, and each welder or welding operator shall apply the personal mark adjacent to the welds using a rubber stamp or felt-tipped marker with permanent, weatherproof ink or other methods approved by the Contracting Officer that do not deform the metal. For seam welds, identification marks shall be placed adjacent to the welds at 3 foot intervals. Identification by die stamps or electric etchers will not be allowed.

##### 1.6.2.3 Renewal of Qualification

Requalification of a welder or welding operator shall be required under any of the following conditions:

- a. When a welder or welding operator has not used the specific welding process for a period of 3 months; the period may be extended to 6 months if the welder or welding operator has been

employed on some other welding process.

- b. When a welder or welding operator has not welded with any process during a period of 3 months, all the personal qualifications shall be considered expired, including any extended by virtue of a., above.
- c. There is specific reason to question the person's ability to make welds that will meet the requirements of the specifications.
- d. The welder or welding operator was qualified by an employer, other than those firms performing work under this contract, and a qualification test has not been taken within the preceding 12 months.
- e. Renewal of qualification for a specific welding process under conditions a., b., and d., above, needs to be made on only a single test joint or pipe of any thickness, position, or material to reestablish the welder's or welding operator's qualification for any thickness, position, or material covered under previous qualification.

#### 1.6.3 Inspection and NDE Personnel

All inspection and NDE personnel shall be qualified in accordance with the following requirements.

##### 1.6.3.1 Inspector Certification

Welding inspectors shall be qualified in accordance with AWS QC1.

##### 1.6.3.2 NDE Personnel

NDE personnel shall be certified, and a written procedure for the control and administration of NDE personnel training, examination, and certification shall be established. The procedures shall be based on appropriate specific and general guidelines of training and experience recommended by ASNT RP SNT-TC-1A, ASNT Q&A Bk A, ASNT RP SNT-TC-1A Bk B, ASNT Q&A Bk C, or ASNT Q&A Bk D, as applicable.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

All filler metals, electrodes, fluxes, and other welding materials shall be delivered to the site in manufacturers' original packages and stored in a dry space until used. Packages shall be properly labeled and designed to give maximum protection from moisture and to insure safe handling.

##### 1.7.1 Material Control

Materials shall be stored in a controlled access and clean, dry area that is weathertight and is maintained at a temperature recommended by the manufacturer. The materials shall not be in contact with the floor and shall be stored on wooden pallets or cribbing.

##### 1.7.1.1 Damaged Containers

Low-hydrogen steel electrodes shall be stored in their sealed shipping container. If the seal is damaged during shipment or storage, and the damage is not immediately detected, the covered electrodes in that

container shall be rebaked in accordance with the manufacturer's instructions prior to issuance or shall be discarded. If a container is damaged in storage and the damage is witnessed, the electrodes from that container shall be immediately placed in a storage oven. The storage oven temperature shall be as recommended by the manufacturer or the welding material specification.

#### 1.7.1.2 Partial Issues

When a container of covered electrodes is opened and only a portion of the content is issued, the remaining portion shall, within 1/2 hour, be placed in a storage oven.

#### 1.7.2 Damaged Materials

Materials which are damaged shall be discarded. Covered electrodes which are oil or water-soaked, dirty, or on which the flux has separated from the wire shall be discarded.

### 1.8 SYMBOLS

Symbols shall be in accordance with AWS A2.4.

### 1.9 SAFETY

Safety precautions shall conform to AWS Z49.1.

## PART 2 PRODUCTS

### 2.1 WELDING MATERIALS

Welding materials shall comply with ASME BPVC SEC II-C. Welding equipment, electrodes, welding wire, and fluxes shall be capable of producing satisfactory welds when used by a qualified welder or welding operator using qualified welding procedures.

## PART 3 EXECUTION

### 3.1 WELDING OPERATIONS

Welding shall be performed in accordance with qualified procedures using qualified welders and welding operators. Welding shall not be done when the quality of the completed weld could be impaired by the prevailing working or weather conditions. The Contracting Officer shall determine when weather or working conditions are unsuitable for welding. Welding of hangers, supports, and plates to structural members shall conform to AWS D1.1.

#### 3.1.1 Base Metal Preparation

Oxy-fuel cutting shall not be used on austenitic stainless steel or nonferrous materials.

#### 3.1.2 Weld Joint Fit-Up

Parts that are to be joined by welding shall be fitted, aligned, and retained in position during the welding operation by the use of bars, jacks, clamps, or other mechanical fixtures. Welded temporary attachments shall not be used except when it is impractical to use mechanical fixtures.

When temporary attachments are used, they shall be the same material as the base metal, and shall be completely removed by grinding or thermal cutting after the welding operation is completed. If thermal cutting is used, the attachment shall be cut to not less than 1/4 inch from the member and the balance removed by grinding. After the temporary attachment has been removed, the area shall be visually examined.

### 3.1.3 Preheat and Interpass Temperatures

Preheat temperatures shall meet the requirements specified by ASME B31.3. However, in no case shall the preheat be below 50 degrees F for ferritic steel or austenitic stainless steel, or 32 degrees F for nonferrous alloys.

The maximum interpass temperatures shall not exceed 300 degrees F for austenitic stainless steels, nickel alloys, and copper alloys; and 500 degrees F for carbon steels. Preheat techniques shall be such as to ensure that the full thickness of the weld joint preparation and/or adjacent base material, at least 3 inches in all directions, is at the specified temperature. Preheating by induction or resistance methods is preferred. When flame heating is used, only a neutral flame shall be employed. Oxy-fuel heating shall not be used on austenitic stainless steel or nickel-alloy materials; however, air-fuel heating is acceptable if controlled to insure that the surface temperature does not exceed 150 degrees F. Interpass temperatures shall be checked on the surface of the component within 1 inch of the weld groove and at the starting location of the next weld pass, and for a distance of about 6 inches ahead of the weld, but not on the area to be welded.

### 3.1.4 Production Welding Instructions

- a. Welding shall not be done when the ambient temperature is lower than 0 degree F.
- b. Welding is not permitted on surfaces that are wet or covered with ice, when snow or rain is falling on the surfaces to be welded, or during periods of high winds, unless the welders and the work are properly protected.
- c. Gases for purging and shielding shall be welding grade and shall have a dew point of minus 40 degrees F or lower.
- d. Back purges are required for austenitic stainless steels and nonferrous alloys welded from one side and shall be set up such that the flow of gas from the inlet to the outlet orifice passes across the area to be welded. The oxygen content of the gas exiting from the purge vent shall be less than 2 percent prior to welding.
- e. The purge on groove welds shall be maintained for at least three layers or 3/16 inch.
- f. Removable purge dam materials shall be made of expandable or flexible plugs, such as plexiglass, plywood (which shall be dry when used), etc. Wood dams shall be kiln-dried quality. Nonremovable purge dams and purge dam adhesives shall be made of water soluble materials. Purge dams shall not be made of polyvinyl alcohol.
- g. Any welding process which requires the use of external gas shielding shall not be done in a draft or wind unless the weld

area is protected by a shelter. This shelter shall be of material and shape appropriate to reduce wind velocity in the vicinity of the weld to a maximum of 5 mph (440 fpm).

- h. Welding of low-alloy and hardenable high-alloy steels may be interrupted provided a minimum of at least 3/8 inch thickness of weld deposit or 25 percent of the weld groove is filled, whichever is greater, and the preheat temperature is maintained during the time that welding is interrupted. If the temperature falls below the minimum preheat temperature before all welding has been completed on a joint, or, where required, before post weld heat treatment, a liquid penetrant or magnetic particle examination shall be performed to insure sound deposited metal before reheating. Welding of other materials may be interrupted without restriction provided a visual inspection is performed before welding is resumed.
- i. Tack welds to be incorporated in the final welds shall have their ends tapered by grinding or welding technique. Tack welds that are cracked or defective shall be removed and the groove shall be retacked prior to welding. Temporary tack welds shall be removed, the surface ground smooth, and visually inspected. For low-alloy and hardenable high-alloy steels, the area shall be magnetic particle examination inspected.
- j. When joining ferritic steel pressure piping components to austenitic stainless steel pressure piping components and postweld heat treatment is required, the following requirements apply:
  - (1) The weld-end preps of ferritic steel components, which are to be welded to austenitic stainless steel, shall be buttered with one of the following weld filler metals and shall conform to the specified requirements:
    - ASME BPVC SEC II-C, SFA 5.14, Classification ERNiCr-3.
    - ASME BPVC SEC II-C, SFA 5.11, Classification ENiCrFe-2.
  - (2) The ferritic steel weld-end prep shall be buttered, receive a postweld heat treatment as required by ASME B31.3, and then be machined with the applicable weld-end preparation. After machining, the buttered layer shall be a minimum of 1/4 inch thick.
  - (3) Pressure piping transition joints shall be completed using ERNiCr-3 or ENiCrFe-2 weld filler metals. No further postweld heat treatment shall be performed.
- k. When joining ferritic steel pressure piping components to austenitic stainless steel pressure piping components and postweld heat treatment is not required, prepare and weld the joint using either ERNiCr-3 or ENiCrFe-2 filler metals. For service temperatures of 200 degrees F or less, stainless filler metal 309 ASME BPVC SEC II-C, SFA 5.4 or 5.9 is permissible in lieu of the nickel-based alloys.
- l. Grinding of completed welds is to be performed only to the extent required for NDE, including any inservice examination, and to provide weld reinforcement within the requirements of ASME B31.3. If the surface of the weld requires grinding, reducing the weld or

base material below the minimum required thickness shall be avoided. Minimum weld external reinforcement shall be flush between external surfaces.

### 3.1.5 Postweld Heat Treatment

Postweld heat treatment shall be performed in accordance with ASME B31.3. Temperatures for local postweld heat treatment shall be measured continuously by thermocouples in contact with the weldment.

Postweld heat treatment of low-alloy steels, when required, shall be performed immediately upon completion of welding and prior to the temperature of the weld falling below the preheat temperature. However, postweld heat treatment may be postponed after the completion of the weld, if, immediately after the weld is completed, it is maintained at a minimum temperature of 300 degrees F or the preheat temperature, whichever is greater, for 2 hours per inch of weld thickness.

For low-alloy steels, the cooling rates shall be such that temper embrittlement is avoided.

## 3.2 EXAMINATIONS, INSPECTIONS, AND TESTS

Visual and NDE shall be performed by the Contractor to detect surface and internal discontinuities in completed welds. The services of a qualified commercial inspection or testing laboratory or technical consultant, approved by the Contracting Officer, shall be employed by the Contractor. All tack welds, weld passes, and completed welds shall be visually inspected. In addition, magnetic particle or liquid penetrant examination shall be performed on root passes. Liquid penetrant or magnetic particle examination shall be required on a random percentage of welds as described below. When inspection and testing indicates defects in a weld joint, the weld shall be repaired by a qualified welder in accordance with paragraph CORRECTIONS AND REPAIRS.

### 3.2.1 Random NDE Testing

The Contractor shall test a minimum of 10 percent of the total length or number of piping welds. The welds inspected shall be selected randomly, but the selection shall include an examination of welds made by each welding operator or welder. If the random testing reveals that any welds fail to meet minimum quality requirements, an additional 10 percent of the welds in that same group shall be inspected. If all of the additional welds inspected meet the quality requirements, the entire group of welds represented shall be accepted and the defective welds shall be repaired. If any of the additional welds inspected also fail to meet the quality requirements, that entire group of welds shall be rejected. The rejected welds shall be removed and rewelded, or the rejected welds shall be 100 percent inspected and all defective weld areas removed and rewelded.

### 3.2.2 Visual Inspection

Weld joints shall be inspected visually as follows:

- a. Before welding - for compliance with requirements for joint preparation, placement of backing rings or consumable inserts, alignment and fit-up, and cleanliness.
- b. During welding - for cracks and conformance to the qualified

welding procedure.

- c. After welding - for cracks, contour and finish, bead reinforcement, undercutting, overlap, and size of fillet welds.

### 3.2.3 NDE Testing

NDE shall be in accordance with written procedures. Procedures for liquid penetrant or magnetic particle, tests and methods shall conform to ASME BPVC SEC V. The approved procedure shall be demonstrated to the satisfaction of the Contracting Officer. In addition to the information required in ASME BPVC SEC V, the written procedures shall include the timing of the NDE in relation to the welding operations and safety precautions.

### 3.2.4 Inspection and Tests by the Government

The Government will perform inspection and supplemental nondestructive or destructive tests as deemed necessary. The cost of supplemental NDE will be borne by the Government. The correction and repair of defects and the reexamination of weld repairs shall be performed by the Contractor at no additional cost to the Government. Inspection and tests will be performed as required for visual inspection and NDE, except that destructive tests may be required also. When destructive tests are ordered by the Contracting Officer and performed by the Contractor and the specimens or other supplemental examinations indicate that the materials and workmanship do not conform to the contract requirements, the cost of the tests, corrections, and repairs shall be borne by the Contractor. When the specimens or other supplemental examinations of destructive tests indicate that materials or workmanship do conform to the specification requirements, the cost of the tests and repairs will be borne by the Government. When destructive tests are made, repairs shall be made by qualified welders or welding operators using welding procedures which will develop the full strength of the members cut. Welding shall be subject to inspection and tests in the mill, shop, and field. When materials or workmanship do not conform to the specification requirements, the work may be rejected at any time before final acceptance of the system containing the weldment.

## 3.3 ACCEPTANCE STANDARDS

### 3.3.1 Visual

The following indications are unacceptable:

- a. Cracks.
- b. Undercut on surface which is greater than 1/32 inch deep.
- c. Weld reinforcement greater than 3/16 inch.
- d. Lack of fusion on surface.
- e. Incomplete penetration (applies only when inside surface is readily accessible).
- f. Convexity of fillet weld surface greater than 10 percent of longest leg plus 0.03 inch.
- g. Concavity in groove welds.

- h. Concavity in fillet welds greater than 1/16 inch.
- i. Fillet weld size less than indicated or greater than 1-1/4 times the minimum indicated fillet leg length.

### 3.3.2 Magnetic Particle Examination

The following relevant indications are unacceptable:

- a. Any cracks and linear indications.
- b. Rounded indications with dimensions greater than 3/16 inch.
- c. Four or more rounded indications in a line separated by 1/16 inch or less edge-to-edge.
- d. Ten or more rounded indications in any 6 square inches of surface with the major dimension of this area not to exceed 6 inches with the area taken in the most unfavorable location relative to the indications being evaluated.

### 3.3.3 Liquid Penetrant Examination

Indications with major dimensions greater than 1/16 of an inch shall be considered relevant. The following relevant indications are unacceptable:

- a. Any cracks or linear indications.
- b. Rounded indications with dimensions greater than 3/16 inch.
- c. Four or more rounded indications in a line separated by 1/16 inch or less edge-to-edge.
- d. Ten or more rounded indications in any 6 square inches of surface with the major dimension of this area not to exceed 6 inches with the area taken in the most unfavorable location relative to the indications being evaluated.

### 3.3.4 Radiography

Welds that are shown by radiography to have any of the following discontinuities are unacceptable:

- a. Porosity in excess of that shown as acceptable in ASME BPVC SEC I, Appendix A-250.
- b. Any type of crack or zone of incomplete fusion or penetration.
- c. Any other elongated indication which has a length greater than:
  - (1) 1/4 inch for t up to 3/4 inch inclusive, where t is the thickness of the thinner portion of the weld.
  - (2) 1/3 t for t from 3/4 inch to 2-1/4 inch, inclusive.
  - (3) 3/4 inch for t over 2-1/4 inch.
- d. Any group of indications in line that have an aggregate length

greater than  $t$  in a length of  $12t$ , except where the distance between the successive indications exceeds  $6L$  where  $L$  is the longest indication in the group.

Where " $t$ " is the thickness of the weld being examined; if a weld joins two members having different thickness at the weld, " $t$ " is the thinner of these two thicknesses.

### 3.3.5 Ultrasonic Examination

Linear-type discontinuities are unacceptable if the amplitude exceeds the reference level and discontinuities have lengths which exceed the following:

- a. 1/4 inch for  $t$  up to 3/4 inch.
- b. 1/3 inch for  $t$  from 3/4 to 2-1/4 inch.
- c. 3/4 inch for  $t$  over 2-1/4 inch.

Where " $t$ " is the thickness of the weld being examined; if the weld joins two members having different thicknesses at the weld, " $t$ " is the thinner of these two thicknesses. Where discontinuities are interpreted to be cracks, lack of fusion, and incomplete penetration, they are unacceptable regardless of length.

### 3.4 CORRECTIONS AND REPAIRS

Defects shall be removed and repaired as specified in ASME B31.3 unless otherwise specified. Disqualifying defects discovered between weld passes shall be repaired before additional weld material is deposited. Wherever a defect is removed, and repair by welding is not required, the affected area shall be blended into the surrounding surface eliminating sharp notches, crevices, or corners. After defect removal is complete and before rewelding, the area shall be examined by the same test method which first revealed the defect to ensure that the defect has been eliminated. After rewelding, the repaired area shall be reexamined by the same test method originally used for that area. Any indication of a defect shall be regarded as a defect unless reevaluation by NDE or by surface conditioning shows that no disqualifying defects are present. The use of any foreign material to mask, fill in, seal, or disguise welding defects will not be permitted.

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## SECTION 05120A

## STRUCTURAL STEEL

01/02

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC ASD Manual (1989) Manual of Steel Construction  
Allowable Stress Design

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 307 (2000) Carbon Steel Bolts and Studs, 60  
000 PSI Tensile Strength

ASTM A 325 (2000) Structural Bolts, Steel, Heat  
Treated, 120/105 ksi Minimum Tensile  
Strength

ASTM A 36/A 36M (2000a) Carbon Structural Steel

ASTM A 500 (1999) Cold-Formed Welded and Seamless  
Carbon Steel Structural Tubing in Rounds  
and Shapes

ASTM A 53/A 53M (2001) Pipe, Steel, Black and Hot-Dipped,  
Zinc-Coated, Welded and Seamless

ASTM A 563 (2000) Carbon and Alloy Steel Nuts

ASTM A 992/A 992M (2000) Steel for Structural Shapes For Use  
in Building Framing

ASTM F 436 (2000) Hardened Steel Washers

ASTM F 844 (2000) Washers, Steel, Plain (Flat),  
Unhardened for General Use

ASTM F 959 (1999a) Compressible-Washer-Type Direct  
Tension Indicators for Use with Structural  
Fasteners

## AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ASNT RP SNT-TC-1A (1996) Recommended Practice SNT-TC-1A

## AMERICAN WELDING SOCIETY (AWS)

AWS A2.4 (1998) Standard Symbols for Welding,  
Brazing and Nondestructive Examination

AWS D1.1 (2000) Structural Welding Code - Steel

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 25 (1991) Red Iron Oxide, Zinc Oxide, Raw  
Linseed Oil and Alkyd Primer (Without Lead  
and Chromate Pigments)

## 1.2 GENERAL REQUIREMENTS

Structural steel fabrication and erection shall be performed by an organization experienced in structural steel work of equivalent magnitude. The Contractor shall be responsible for correctness of detailing, fabrication, and for the correct fitting of structural members. Connections, for any part of the structure not shown on the contract drawings, shall be considered simple shear connections and shall be designed and detailed in accordance with pertinent provisions of AISC ASD Manual. Substitution of sections or modification of connection details will not be accepted unless approved by the Contracting Officer. AISC ASD Manual shall govern the work. Welding shall be in accordance with AWS D1.1. High-strength bolting shall be in accordance with AISC ASD Manual.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Structural Steel System; G-DO  
Structural Connections; G-DO

Shop and erection details including members (with their connections) not shown on the contract drawings. Welds shall be indicated by standard welding symbols in accordance with AWS A2.4.

### SD-03 Product Data

#### Erection

Prior to erection, erection plan of the structural steel framing describing all necessary temporary supports, including the sequence of installation and removal.

#### Welding; G-AO

WPS not prequalified.

WPS prequalified.

### SD-06 Test Reports

## Quality Control; G-AO

A quality assurance plan and records of tests and inspections.

## SD-07 Certificates

## Mill Test Reports

Certified copies of mill test reports for structural steel, structural bolts, nuts, washers and other related structural steel items, including attesting that the structural steel furnished contains no less than 25 percent recycled scrap steel and meets the requirements specified, prior to the installation.

## Welder Qualifications; G-AO

Certified copies of welder qualifications test records showing qualification in accordance with AWS D1.1.

## Welding Inspector; G-AO

Welding Inspector qualifications.

## 1.4 STORAGE

Material shall be stored out of contact with the ground in such manner and location as will minimize deterioration.

## 1.5 WELDING INSPECTOR

Welding Inspector qualifications shall be in accordance with AWS D1.1 Nondestructive testing personnel shall be qualified in accordance with the requirements of ASNT RP SNT-TC-1A for Levels I or II in the applicable nondestructive testing method. The inspector may be supported by assistant welding inspectors who are not qualified to ASNT RP SNT-TC-1A, and assistant inspectors may perform specific inspection functions under the supervision of the qualified inspector.

## PART 2 PRODUCTS

## 2.1 STRUCTURAL STEEL

## 2.1.1 Carbon Grade Steel

Carbon grade steel shall conform to ASTM A 36/A 36M or ASTM A 992/A 992M.

## 2.2 HOLLOW STRUCTURAL SECTIONS (HSS)

HSS shall conform to ASTM A 500, Grade B.

## 2.3 STEEL PIPE

Steel pipe shall conform to ASTM A 53/A 53M, Type E, Grade B.

## 2.4 HIGH STRENGTH BOLTS AND NUTS

High strength bolts shall conform to ASTM A 325, Type 1 with carbon steel nuts conforming to ASTM A 563, Grade C.

## 2.5 CARBON STEEL BOLTS AND NUTS

Carbon steel bolts shall conform to ASTM A 307, Grade A with carbon steel nuts conforming to ASTM A 563, Grade A.

## 2.6 NUTS DIMENSIONAL STYLE

Carbon steel nuts shall be Heavy Hex style when used with ASTM A 307 bolts or Heavy Hex style when used with ASTM A 325 bolts.

## 2.7 WASHERS

Plain washers shall conform to ASTM F 844. Other types, when required, shall conform to ASTM F 436 or ASTM F 959.

## 2.8 PAINT

Paint shall conform to SSPC Paint 25.

# PART 3 EXECUTION

## 3.1 FABRICATION

Fabrication shall be in accordance with the applicable provisions of AISC ASD Manual. Fabrication and assembly shall be done in the shop to the greatest extent possible. Structural steelwork, except surfaces of steel to be encased in concrete, surfaces to be field welded, and contact surfaces of friction-type high-strength bolted connections shall be prepared for painting in accordance with AISC ASD Manual and primed with the specified paint.

## 3.2 ERECTION

The Contractor shall be responsible for the safe erection of the steel framing. The Contractor shall determine where any temporary supports may be required to secure any elements of the steel framing, and shall provide such shoring or bracing until the elements are made stable by interaction with other elements of the framing.

### 3.2.1 Structural Connections

Anchor bolts and other connections between the structural steel and foundations shall be provided and shall be properly located and built into connecting work. Field welded structural connections shall be completed before load is applied.

### 3.2.2 Base Plates and Bearing Plates

Column base plates for columns and bearing plates for beams, girders, and similar members shall be provided. Base plates and bearing plates shall be provided with full bearing after the supported members have been plumbed and properly positioned, but prior to placing superimposed loads. Separate setting plates under column base plates will not be permitted. The area under the plate shall be damp-packed solidly with bedding mortar. Bedding mortar shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

### 3.2.3 Field Priming

After erection, the field bolt heads and nuts, field welds, and any abrasions in the shop coat shall be cleaned and primed with paint of the same quality as that used for the shop coat.

### 3.3 WELDING

The contractor shall develop and submit the Welding Procedure Specifications (WPS) for all welding, including welding done using prequalified procedures. Prequalified procedures may be submitted for information only; however, procedures that are not prequalified shall be submitted for approval.

### 3.4 INSPECTION OF FIELD WELDED MOMENT CONNECTIONS

Field welded moment connections of roof beams to columns (indicated by moment connection symbol on drawings) shall be inspected as follows:

Visual inspection	100%
Ultrasonic Testing (UT)	random 10%

Testing shall be done by an approved inspection or testing laboratory or technical consultant. Procedures and techniques for inspection shall be in accordance with applicable requirements of AWS D1.1. Dimensional tolerances for welded construction, details of welds, and quality of welds shall be in accordance with the applicable requirements of AWS D1.1. When inspection or testing indicates defects in the weld joints, the welds shall be repaired using a qualified welder or welding operator as applicable. Repair welds shall meet the inspection requirements for the original welds.

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## SECTION 05300A

STEEL DECKING  
01/02

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC ASD Spec S335 (1989) Specification for Structural Steel Buildings - Allowable Stress Design, Plastic Design

## AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI Cold-Formed Mnl (1996) Cold-Formed Steel Design Manual

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 108 (1999) Steel Bars, Carbon, Cold-Finished, Standard Quality

ASTM A 570/A 570M (1998) Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality

ASTM A 611 (1997) Structural Steel (SS), Sheet, Carbon, Cold-Rolled

ASTM A 653/A 653M (2000) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A 780 (2000) Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings

ASTM A 792/A 792M (1999) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

ASTM C 423 (1999a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

ASTM E 795 (2000) Mounting Test Specimens During Sound Absorption Tests

## AMERICAN WELDING SOCIETY (AWS)

AWS D1.1 (2000) Structural Welding Code - Steel

AWS D1.3 (1998) Structural Welding Code - Sheet

## Steel

## STEEL DECK INSTITUTE (SDI)

SDI Diaphragm Mnl (1991) Diaphragm Design Manual

SDI Pub No. 29 (1995) Design Manual for Composite Decks, Form Decks, Roof Decks, and Cellular Metal Floor Deck with Electrical Distribution

## THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 20 (1991) Zinc-Rich Primers (Type I - "Inorganic" and Type II - "Organic")

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Deck Units; G-DO  
Accessories; G-DO  
Attachments; G-DO  
Holes and Openings; G-DO

Drawings shall include type, configuration, structural properties, location, and necessary details of deck units, accessories, and supporting members; size and location of holes to be cut and reinforcement to be provided; location and sequence of welded or fastener connections; and the manufacturer's erection instructions; and manufacturer's certificates attesting that the decking material meets the specified requirements.

## SD-03 Product Data

Deck Units; G-AO

Design computations for the structural properties of the deck units or SDI certification that the units are designed in accordance with SDI specifications.

Attachments; G-AO

Prior to attaching deck to steel framing, copies of qualified procedures and lists of names and identification symbols of qualified welders and welding operators, and/or manufacturer's certificate attesting that the operators are authorized to use the low-velocity piston tool.

## 1.3 DELIVERY, STORAGE, AND HANDLING

Deck units shall be delivered to the site in a dry and undamaged condition, stored off the ground with one end elevated, and stored under a weathertight covering permitting good air circulation. Finish of deck

units shall be maintained at all times by using touch-up paint whenever necessary to prevent the formation of rust.

## PART 2 PRODUCTS

### 2.1 DECK UNITS

Deck units shall conform to SDI Pub No. 29. Panels of maximum possible lengths shall be used to minimize end laps. Deck units shall be fabricated in lengths to span 3 or more supports with flush, telescoped, or nested 2 inch laps at ends, and interlocking, or nested side laps, unless otherwise indicated. Deck with cross-sectional configuration differing from the units indicated may be used, provided that the properties of the proposed units, determined in accordance with AISI Cold-Formed Mnl, are equal to or greater than the properties of the units indicated and that the material will fit the space provided without requiring revisions to adjacent materials or systems.

#### 2.1.1 Roof Deck

Steel deck used in conjunction with insulation and built-up roofing shall conform to ASTM A 611 or ASTM A 792/A 792M. Roof deck units shall be fabricated of the steel design thickness required by the design drawings and shall be shop painted or galvanized as indicated on the drawings.

#### 2.1.2 Form Deck

Deck used as a permanent form for concrete shall conform to ASTM A 653/A 653M or ASTM A 611. Deck used as a form for concrete shall be fabricated of the steel design thickness required by the design drawings, and shall be painted with one coat of manufacturer's standard paint or galvanized G60 coating class, as indicated on the drawings. Galvanizing and paints containing zinc are potentially hazardous to fish in the building, and shall not be used, except where galvanizing is specifically indicated on the drawings.

### 2.2 TOUCH-UP PAINT

Touch-up paint for shop-painted units shall be of the same type used for the shop painting, and touch-up paint for galvanized units shall be an approved galvanizing repair paint with a high-zinc dust content. Welds on painted deck units shall be touched-up with a touch-up paint which does not contain zinc. Welds on galvanized deck units shall be touched-up with a paint conforming to SSPC Paint 20 in accordance with ASTM A 780. Finish of deck units and accessories shall be maintained by using touch-up paint whenever necessary to prevent the formation of rust.

### 2.3 ADJUSTING PLATES

Adjusting plates or segments of deck units shall be provided in locations too narrow to accommodate full-size units. As far as practical, the plates shall be the same thickness and configuration as the deck units.

### 2.4 CLOSURE PLATES

#### 2.4.1 Closure Plates for Roof Deck

Voids above interior walls shall be closed with sheet metal where shown. Open deck cells at parapets, end walls, eaves, and openings through roofs

shall be closed with sheet metal. Sheet metal shall be same thickness as deck units.

## 2.5 ACCESSORIES

The manufacturer's standard accessories shall be furnished as necessary to complete the deck installation. Metal accessories shall be of the same material as the deck and have minimum design thickness as follows: saddles, 0.0474 inch; cant strip, 0.0295 inch; other metal accessories, 0.0358 inch; unless otherwise indicated. Accessories shall include but not be limited to saddles, welding washers, cant strips, butt cover plates, underlapping sleeves, and ridge and valley plates.

## PART 3 EXECUTION

### 3.1 ERECTION

Erection of deck and accessories shall be in accordance with SDI Pub No. 29 and SDI Diaphragm Mnl and the approved detail drawings. Damaged deck and accessories including material which is permanently stained or contaminated, with burned holes or deformed shall not be installed. The deck units shall be placed on secure supports, properly adjusted, and aligned at right angles to supports before being permanently secured in place. The deck shall not be filled with concrete, or used for storage or as a working platform until the units have been secured in position. Loads shall be distributed by appropriate means to prevent damage during construction and to the completed assembly. The maximum uniform distributed storage load shall not exceed the design live load. There shall be no loads suspended directly from the steel deck.

### 3.2 ATTACHMENTS

All fasteners shall be installed in accordance with the manufacturer's recommended procedure, except as otherwise specified. The deck units shall be welded with nominal 5/8 inch diameter puddle welds or fastened with screws, powder-actuated fasteners or pneumatically driven fasteners to supports as indicated on the design drawings and in accordance with requirements of SDI Pub No. 29. All welding of steel deck shall be in accordance with AWS D1.3 using methods and electrodes as recommended by the manufacturer of the steel deck being used. Welds shall be made only by operators previously qualified by tests prescribed in AWS D1.3 to perform the type of work required. Welding washers shall not be used at the connections of the deck to supports. Welding washers shall not be used at sidelaps. Holes and similar defects will not be acceptable. Deck ends shall be lapped 2 inches. All partial or segments of deck units shall be attached to structural supports in accordance with Section 2.5 of SDI Diaphragm Mnl. Powder-actuated fasteners shall be driven with a low-velocity piston tool by an operator authorized by the manufacturer of the piston tool. Pneumatically driven fasteners shall be driven with a low-velocity fastening tool and shall comply with the manufacturer's recommendations.

### 3.3 HOLES AND OPENINGS

All holes and openings required shall be coordinated with the drawings, specifications, and other trades. Holes and openings shall be drilled or cut, reinforced and framed as indicated on the drawings or described in the specifications and as required for rigidity and load capacity. Holes and openings less than 6 inches across require no reinforcement. Holes and

openings 6 to 12 inches across shall be reinforced by 0.0474 inch thick steel sheet at least 12 inches wider and longer than the opening and be fastened to the steel deck at each corner of the sheet and at a maximum of 6 inches on center. Holes and openings larger than 12 inches shall be reinforced by steel angles installed perpendicular to the steel joists and supported by the adjacent steel joists. Steel angles shall be installed perpendicular to the deck ribs and shall be fastened to the angles perpendicular to the steel joists.

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## SECTION 05400A

COLD-FORMED STEEL FRAMING  
01/02

## PART 1 GENERAL

This specification section contains requirements for cold-formed steel framing for use in exterior walls. Metal framing for interior walls is specified in Section 09250 Gypsum Wallboard.

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

## AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI Cold-Formed Spec (1996) Specification & Commentary for the Design of Cold-Formed Steel Structural Members (Part V of the Cold-Formed Steel Design Manual)

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123/A 123M (2001) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 153/A 153M (2001) Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A 370 (1997a) Mechanical Testing of Steel Products

ASTM B 633 (1985; R 1998) Electrodeposited Coatings of Zinc on Iron and Steel

ASTM E 329 (2000b) Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

## AMERICAN WELDING SOCIETY (AWS)

AWS D1.3 (1998) Structural Welding Code - Sheet Steel

## SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J 78 (1998) Steel Self Drilling Tapping Screws

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When

used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

##### Framing Components; G-DO

Details of cold-formed steel framing and support around openings, including framing connections, bridging, and attachment to other building elements. Drawings shall indicate thickness, material, dimensions, protective coatings, and section properties of all steel studs and other cold-formed steel framing members. Drawings shall also indicate size and type of all fasteners including welds.

#### SD-05 Design Data

##### Steel Studs, Tracks, Bracing, Bridging, AND Accessories; G-DO

Calculations or tabular data as necessary, demonstrating the structural performance of the cold-formed steel framing system for the specified loadings and deflection criteria in accordance with the provisions of AISI-01.

#### SD-07 Certificates

##### Mill Certificates

Mill certificates or test reports from independent testing agency, qualified in accordance with ASTM E 329, showing that the steel sheet used in the manufacture of each cold-formed component complies with the minimum yield strengths and uncoated steel thickness specified. Test reports shall be based on the results of three coupon tests in accordance with ASTM A 370.

##### Welds

Certified copies of welder qualifications test records showing qualification in accordance with AWS D1.3.

### 1.3 DELIVERY, HANDLING AND STORAGE

Materials shall be delivered and handled preventing bending or other damage, and avoiding contact with soil or other contaminating materials. Finish of the framing members shall be maintained at all times, using an approved high zinc dust content, galvanizing repair paint whenever necessary to prevent the formation of rust.

## PART 2 PRODUCTS

### 2.1 STEEL STUDS, TRACKS, BRACING, BRIDGING, AND ACCESSORIES

#### 2.1.1 Framing System

Cold-formed framing for use in exterior walls shall consist of steel studs, top and bottom tracks, runners, horizontal bridging, and other cold-formed members and other accessories. The cold-formed framing system shall be designed in accordance with AISI-01. The steel studs and other framing members within the wall shall be designed to resist the wind loadings shown

on the contract drawings. Wind loads shall be applied both inward and outward perpendicular to the wall system without exceeding 1/360 times the vertical stud span and AISI-01 allowable stresses. All cold-formed members shall be hot-dip galvanized in accordance with ASTM A 653/A 653M with a minimum coating thickness of G 60.

### 2.1.2 Steel Studs

Studs shall conform to ASTM A 653/A 653M, Grade 33, having a minimum yield of 33 ksi. Stud section properties and materials shall be as required by the Contractor's design, but shall have properties not less than the following:

Base Metal Thickness	20 gage (design thickness = 0.036 inch, min. delivered thickness shall not be less than 95% of design thickness. )
Stud Depth	6-inch
Flange Width	1 3/8 inches
Return Lip	1/4 inches

Section properties shall be determined in accordance with AISI-01.

### 2.1.3 Runners, Tracks, Bridging and Accessories

Cold-formed framing members, components, and accessories, other than steel studs, shall conform to ASTM C 955 and be of steel conforming to ASTM A 653/A 653M, Grade 33, having a minimum yield strength of 33 ksi.

## 2.2 CONNECTIONS

Screws for steel-to-steel connections shall be self-drilling tapping in compliance with SAE J 78 of the type, size, and location as shown on the drawings. Electroplated screws shall have a Type II coating in accordance with ASTM B 633. Screws, bolts, and anchors shall be hot-dipped galvanized in accordance with ASTM A 123/A 123M or ASTM A 153/A 153M as appropriate. Screws bolts, and anchors shall be hot dipped galvanized in accordance with ASTM A 123/A 123M or ASTM A 153/A 153M as appropriate.

## PART 3 EXECUTION

### 3.1 Delivery, Handling and Storage

a. Materials shall be delivered and handled in a manner to avoid bending or other damage and to avoid contact with the soil or other contaminating materials.

b. Finish of the framing members shall be maintained at all times, using an approved high zinc dust content galvanizing repair paint whenever necessary to prevent the formation of rust.

### 3.2 CONNECTIONS

#### 3.2.1 Welds

All welding shall be performed in accordance with AWS D1.3, as modified by AISI Cold-Formed Spec. All welders, welding operations, and welding

procedures shall be qualified according to AWS D1.3. All welds shall be cleaned and coated with rust inhibitive galvanizing paint.

### 3.2.2 Screws

Screws shall be self-drilling self-tapping, of the type, size, and location as required by the design. Screw penetration through joined materials shall not be less than three exposed threads. Minimum spacings and edge distances for screws shall be as specified in AISI Cold-Formed Spec. Screws covered by sheathing materials shall have low profile heads.

### 3.2.3 Anchors

Anchors shall be of the type, size, and location as required by the design.

## 3.3 INSTALLATION

### 3.3.1 General Requirements

- a. Prefabricated frames shall be square, with components attached to prevent racking during fabrication, transportation, and lifting. Design and construction of frames shall include provisions for lifting.
- b. Cutting of steel framing shall be by saw, shear, or plasma cutting equipment. Oxyacetylene torch cutting is not permitted.
- c. Temporary bracing shall be provided and remain in place until work is permanently stabilized.
- d. Abutting lengths of track shall be butt-welded, spliced, or each length securely anchored to a common structural element. Track shall be securely anchored to the supporting structure as shown on the drawings.
- e. Splicing of framing components, other than track and tension members, is not permitted.
- f. Wire tying of framing members is not permitted.

### 3.3.2 Non-Load Bearing Walls (Curtain walls)

- a. Studs shall be spaced as required by the design, but center-to-center spacing shall not exceed 16-inches.
- b. Studs shall be plumbed, aligned, and secured to the continuous runner tracks at each end, unless the stud end terminates at a deflection track.
- c. Tracks shall be securely anchored to the supporting structure as shown on the drawings.
- d. Bridging spaced as required by the design shall be installed prior to the installation of facing materials.
- e. Framed wall openings shall include headers and supporting components as shown on the drawings. Headers shall be installed in all openings that are larger than the stud spacing in a wall.

- f. At wall openings for doors, windows and other similar features, the framing system shall provide for the installation and anchorage of the required subframes or finish frames. Steel frames shall be securely attached through built-in anchors to the nearest stud on each side of the opening with self-drilling screws. Double studs shall be provided at both jambs of all door openings.
- g. Installation of sheathing, wallboards, or any other collateral material shall be performed in accordance with the product manufacturer's specifications.
- h. Components (Deflection Track and/or Slide Clips) shall be provided at locations shown on the drawings to accommodate potential movements of Primary Frames. Construction shall accommodate a vertical movement of 1/2-inch.

#### 3.4 TOLERANCES

Vertical alignment (plumbness) of studs shall be within 1/960th of the span. Horizontal alignment (levelness) of walls shall be within 1/960th of their respective lengths. Spacing of studs shall not be more than plus 1/8 inch from the designed spacing providing the the cumulative error does not exceed the requirements of the finishing material.

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## SECTION 05500A

MISCELLANEOUS METAL  
01/02

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## ALUMINUM ASSOCIATION (AA)

AA DAF-45 (1997) Designation System for Aluminum Finishes

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A14.3 (1992) Ladders - Fixed - Safety Requirements

ANSI MH28.1 (1982) Design, Testing, Utilization, and Application of Industrial Grade Steel Shelving

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123/A 123M (2001) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 126 (1984) Gray Iron Castings for Valves, Flanges, and Pipe Fittings

ASTM A 283/A 283M (2000) Low and Intermediate Tensile Strength Carbon Steel Plates

ASTM A 36/A 36M (2000a) Carbon Structural Steel

ASTM A 467/A 467M (1998) Machine and Coil Chain

ASTM A 475 (1998) Zinc-Coated Steel Wire Strand

ASTM A 500 (1999) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

ASTM A 53/A 53M (2001) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A 653/A 653M (2000) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A 924/A 924M (1999) General Requirements for Steel

	Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B 209	(2002a) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 308	(2002) Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles
ASTM B 221	(2000) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B 221M	(2000) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM B 26/B 26M	(1999) Aluminum-Alloy Sand Castings
ASTM B 429	(2000) Aluminum-Alloy Extruded Structural Pipe and Tube
ASTM D 2047	(1999) Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine
ASTM E 814	(2000) Fire Tests of Through-Penetration Fire Stops
ASTM F 1267	(1991; R 1997) Metal, Expanded, Steel
AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)	
ASCE 7	(1998) Minimum Design Loads for Buildings and Other Structures
AMERICAN WELDING SOCIETY (AWS)	
AWS D1.1	(2000) Structural Welding Code - Steel
AWS D1.2	(1997) Structural Welding Code-Aluminum
NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)	
NAAMM MBG 531	(1994) Metal Bar Grating Manual
NAAMM MBG 532	(1994) Heavy Duty Metal Bar Grating Manual
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 10	(1998; Errata 10-98-1) Portable Fire Extinguishers
NFPA 211	(2000) Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances
U.S. GENERAL SERVICES ADMINISTRATION (GSA)	

CID A-A-344 (Rev B) Lacquer, Clear Gloss, Exterior,  
Interior

STEEL STRUCTURES PAINTING COUNCIL SPECIFICATIONS (SSPC)

SSPC SP 1 (1982) Solvent Cleaning

SSPC Paint 16 (1991) Coal Tar Epoxy-Polyamide Black (or  
Dark Red) Paint

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Miscellaneous Metal Items; G-DO.

Detail drawings indicating material thickness, type, grade, and class; dimensions; and construction details. Drawings shall include catalog cuts, erection details, manufacturer's descriptive data and installation instructions, and templates. Detail drawings for the following items: floor grating and frames, valve pit access frames and covers, fire extinguisher cabinets, dock bumpers, and stairs and handrails.

Canal Gates; G-DO.

Drawings of canal gates.

Expansion Anchor;

Copies of ICBO reports, including all allowable load data.

SD-04 Samples

Miscellaneous Metal Items; G-DO.

Samples of the following items: floor gratings and frames. Samples shall be full size, taken from manufacturer's stock, and shall be complete as required for installation in the structure. Samples may be installed in the work, provided each sample is clearly identified and its location recorded.

1.3 GENERAL REQUIREMENTS

The Contractor shall verify all measurements and shall take all field measurements necessary before fabrication. Welding to or on structural steel shall be in accordance with AWS D1.1. Items specified to be galvanized, when practicable and not indicated otherwise, shall be hot-dip galvanized after fabrication. Galvanized products and paints containing zinc present a potential hazard to fish, and shall not be used except where specifically indicated on the drawings. No galvanized products shall be permitted in fish production areas consisting of the following rooms: 113, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, and 152.

Galvanizing shall be in accordance with ASTM A 123/A 123M, ASTM A 653/A 653M, or ASTM A 924/A 924M, as applicable. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and shall harmonize with the material to which fastenings are applied. Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, shall be included. Poor matching of holes for fasteners shall be cause for rejection. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Joints exposed to the weather shall be formed to exclude water.

#### 1.4 DISSIMILAR MATERIALS

Where dissimilar metals are in contact, or where aluminum is in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, the surfaces shall be protected with a coat of bituminous paint or asphalt varnish.

#### 1.5 WORKMANSHIP

Miscellaneous metalwork shall be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Welding shall be continuous along the entire area of contact except where tack welding is permitted. Exposed connections of work in place shall not be tack welded. Exposed welds shall be ground smooth. Exposed surfaces of work in place shall have a smooth finish, and unless otherwise approved, exposed riveting shall be flush. Where tight fits are required, joints shall be milled. Corner joints shall be coped or mitered, well formed, and in true alignment. Work shall be accurately set to established lines and elevations and securely fastened in place. Installation shall be in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

#### 1.6 ANCHORAGE

Anchorage shall be provided where necessary for fastening miscellaneous metal items securely in place. Anchorage not otherwise specified or indicated shall include slotted inserts made to engage with the anchors, expansion shields, and power-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; and lag bolts and screws for wood.

#### 1.7 ALUMINUM FINISHES

Unless otherwise specified, aluminum items shall have standard mill finish. The thickness of the coating shall be not less than that specified for protective and decorative type finishes for items used in interior locations or architectural Class I type finish for items used in exterior locations in AA DAF-45. Items to be anodized shall receive a polished satin finish. Aluminum surfaces to be in contact with concrete during construction shall be protected with a field coat conforming to CID A-A-344.

#### 1.8 SHOP PAINTING

Surfaces of ferrous metal except galvanized surfaces, shall be cleaned and shop coated with the manufacturer's standard protective coating unless otherwise specified. Surfaces of items to be embedded in concrete shall not be painted. Items to be finish painted shall be prepared according to manufacturer's recommendations or as specified.

## PART 2 PRODUCTS

## 2.1 ACCESS DOORS AND PANELS

Doors and panels shall be flush type unless otherwise indicated. Frames for access doors shall be fabricated of not lighter than 16 gauge steel with welded joints and finished with anchorage for securing into construction. Access doors shall be a minimum of 14 by 20 inches, except where otherwise indicated, and of not lighter than 14 gauge steel, with stiffened edges, complete with attachments. Access doors shall be hinged to frame and provided with a flush face, screw driver operated latch. Exposed metal surfaces shall have a shop applied prime coat.

## 2.2 NOT USED.

## 2.3 PIPE GUARDS

Pipe guards shall be heavy duty steel pipe conforming to ASTM A 53/A 53M, Type E or S, weight STD, black finish.

## 2.4 DOWNSPOUT BOOTS

Downspout boots shall be cast iron with receiving bells sized to fit downspouts.

## 2.5 FLOOR GRATINGS AND FRAMES

Carbon steel grating shall have the bearing bars of the dimensions and spacings as shown on the drawings and shall be designed and detailed in accordance with NAAMM MBG 531 to meet the indicated load requirements. Edges shall be banded with bars 1/4 inch less in height than bearing bars for grating sizes above 3/4 inch. Banding bars shall be flush with the top of bearing grating. Frames shall be of welded steel construction finished to match the grating. Floor gratings and frames shall be galvanized after fabrication.

## 2.6 HANDRAILS

Handrails shall be designed to resist a concentrated load of 200 pounds in any direction at any point of the top of the rail or 20 pounds per foot applied horizontally to top of the rail, whichever is more severe.

## 2.6.1 Steel Handrails, Including Carbon Steel Inserts

Steel handrails shall be steel pipe conforming to ASTM A 53/A 53M. Steel railings shall be 1-1/2 inch nominal size. All exterior stair handrails and chain guards shall be galvanized steel and all interior stair and ramp handrails shall be steel materials and painted. All handrails items shall be painted in accordance with SECTION: 09900 and finish color in accordance with SECTION: 09915. Railings shall be hot-dip galvanized and shop painted, accordingly. Pipe collars shall be hot-dip galvanized steel.

- a. Joint posts, rail, and corners shall be fabricated by one of the following methods:

- (1) Flush type rail fittings of commercial standard, welded and ground smooth with railing splice locks secured with 3/8 inch hexagonal recessed-head setscrews.

(2) Mitered and welded joints by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints, and grinding smooth. Railing splices shall be butted and reinforced by a tight fitting interior sleeve not less than 6 inches long.

(3) Railings may be bent at corners in lieu of jointing, provided bends are made in suitable jigs and the pipe is not crushed.

b. Removable sections and brackets shall be provided as indicated.

#### 2.6.2 Aluminum Shelving

Aluminum shelving shall be provided as shown on the drawings. Aluminum framing materials shall be in compliance with ASTM B 308 and ASTM B 221. Aluminum sheeting and plate materials shall be in compliance with ASTM B 209. Sizes and shapes of aluminum shelving materials shall be as shown on the drawings.

#### 2.7 LADDER

Ladder shall be galvanized steel unless otherwise indicated, fixed rail type in accordance with the drawings.

#### 2.8 MIRROR FRAMES

Frames for plate glass mirrors larger than 18 by 30 inches shall be fabricated from extruded aluminum with anodized finish. Frames shall be provided with concealed fittings and tamperproof mountings.

#### 2.9 MISCELLANEOUS

Miscellaneous plates and shapes for items that do not form a part of the structural steel framework, such as lintels, sill angles, miscellaneous mountings, and frames, shall be provided to complete the work.

#### 2.10 FLOOR MATS

Floor mat requirements are specified in SECTION: 12690 ENTRANCE MATS.

#### 2.11 SAFETY CHAINS

Safety chains shall be galvanized welded steel, proof coil chain tested in accordance with ASTM A 467/A 467M, Class CS. Safety chains shall be straight link style, 3/16 inch diameter, minimum 12 links per foot and with bolt type snap hooks on each end. Eye bolts for attachment of chains shall be galvanized 3/8 inch bolt with 3/4 inch eye, anchored as indicated. Two chains shall be furnished for each guarded opening.

#### 2.12 SAFETY NOSING

Safety nosings shall be of cast aluminum with cross-hatched, abrasive surface. Nosing shall be 3 inches wide and terminating at not more than 6 inches from the ends of treads, except nosing for metal pan cement-filled treads shall extend the full length of the tread. Safety nosings shall be provided with anchors not less than 3/4 inch long. Integrally cast mushroom anchors are not acceptable.

### 2.13 STEEL STAIRS

Steel stairs shall be complete with structural or formed channel stringers, metal pan cement-filled treads and steel plate risers, landings, columns, handrails, and necessary bolts and other fastenings as indicated. Structural steel shall conform to ASTM A 36/A 36M. Stairs and accessories shall not contain any galvanized materials for the interior stairs and handrail items. Integral nosings shall have braces extended into the concrete fill, where shown on the drawings.

### 2.14 STEEL DOOR FRAMES

Steel door frames built from structural shapes shall be neatly mitered and securely welded at the corners with all welds ground smooth. Jambs shall be provided with 2 by 1/4 by 12 inch bent, adjustable metal anchors spaced not over 2 feet 6 inches on centers. Provision shall be made to stiffen the top member for all spans over 3 feet. Continuous door stops shall be made of 1-1/2 by 5/8 inch bars.

### 2.15 DOCK BUMPERS

Laminated rubber dock bumpers shall be a product regularly produced by a manufacturer. Overall bumper size shall be approximately 13" width x 12" height x 6" thick. See drawings for locations. Bumpers shall be a tough pile of truck tire material shall be laminated between galvanized steel angles, as shown on the drawings. Bumpers shall be maintenance free and include a minimum 5 year warranty, which shall be provided by the manufacturer for the dock bumpers.

### 2.16 FIRE EXTINGUISHER CABINETS

Cabinets to be located in fire-rated walls shall be fire-rated type, fabricated in accordance with ASTM E 814, and shall be listed by an approved testing agency for 1- and 2-hour combustible and non-combustible wall systems. The testing agency's seal shall be affixed to each fire-rated cabinet. Cabinets shall be of the recessed type suitable for 10 pound extinguishers. Box and trim shall be of heavy gage rolled steel. Door shall be a rigid frame with full length piano type hinge and double strength (DSA) glass panel. Door and panel shall be prime-coated inside and out.

### 2.17 CANAL GATES

Canal gates shall be the product of one manufacturer regularly engaged in the manufacturing of similar units and shall be installed as indicated on the drawings complete with all necessary appurtenances. All connecting elements as welds and bolted connections shall be secure and permanent. Each gate shall be capable of withstanding a minimum seating head of 10 feet. Each gate shall provide an opening equal in size to the opening in the concrete wall as shown. All component parts shall be so proportioned that they will withstand, without distortion or damage, the full stress to which they may be subjected during erection or service. Frames, guides, leaves, and seating wedges shall be cast iron conforming to ASTM A 126 Class B. All contact surfaces of the frame shall be machined. Seat facing shall be firmly secured in finished grooves in the frame in such a way as to ensure that they will remain in place, free from distortion and loosening during the life of the gate. Seat facings shall be machined to a watertight joint with the gate leaf facing. Bolts and expansion anchors shall be stainless steel. Expansion anchors shall be wedge type that have

been tested and listed in the International Conference of Building Officials (ICBO). Gate guides shall be of sufficient length that not less than one-half of the gate leaf is within the guides when the gate is fully opened. The guides shall be machined to fit the frames and shall be bolted to it or secured by anchor bolts or cast integrally with it. Fully adjustable wedge facings, machined on all bearing surfaces, shall be attached to the frame assembly at the points of contact and shall make accurate contact with the wedges of the gate leaf. All wedges on the gate shall be adjusted to approximately the same tension. The gate leaf shall consist of a flat plate reinforced with horizontal and vertical ribs to transmit the load uniformly onto the bearing surfaces. The gate leaf shall have a heavily reinforced cast bracket or pocket for receiving the stem nut. Seat facings shall be accurately machined to ensure a close fit for the full length of the leaf. The gates shall be provided with stainless steel rising stem of sufficient diameter to withstand without buckling the thrust due to closing the gate. The stem shall be attached to the gate leaf by a bronze or stainless steel thrust nut, threaded and secured by key to the stem, and fixed in the leaf to prevent turning. Stem guides shall be fabricated from steel conforming to ASTM A 36 and shall be furnished as required. Stem guides shall be fully adjustable in two directions and shall be provided with bronze bushings. Cast iron gates shall be coated with a coal-tar paint conforming to SSPC Paint 16. Surfaces to be painted shall be cleaned in accordance with SSPC SP 1 and dry before applying paint. Grease, dirt and other soiling substances shall be removed from surfaces to be painted by means of emulsions, steam solvents or others approved means. Rust and loose mill scale shall be removed by high speed power brushing, scraping, chipping, disc-sanding or other approved means. Following installation, all surfaces which have been damaged shall be prepared and repainted to provide a finished coating equivalent to the original coating. The gate shall be completely assembled in the shop and checked to ensure that all parts fit accurately together. Closure of gate leaf against the gate frame fit and interchangeability of parts shall be specifically and accurately checked. After installation, the gate assembly shall be tested in the presence of the Contracting Officer.

## 2.18 ALUMINUM INCUBATOR RACKS

Incubator racks as shown in the drawings shall be constructed of aluminum standard structural shapes conforming to ASTM B 308, Alloy 6061, Temper T-6, mill finish and plates conforming to ASTM 5052-H32 or 5086-H116, mill finish. Welds shall be in accordance with AWS D1.2. Fasteners shall be aluminum or stainless steel. Carbon steel items shall be isolated from contact with aluminum.

## PART 3 EXECUTION

### 3.1 GENERAL INSTALLATION REQUIREMENTS

All items shall be installed at the locations shown and according to the manufacturer's recommendations. Items listed below require additional procedures as specified.

### 3.2 REMOVABLE ACCESS PANELS

A removable access panel not less than 12 by 12 inches shall be installed directly below each valve, flow indicator, damper, or air splitter that is located above the ceiling, other than an acoustical ceiling, and that would otherwise not be accessible.

### 3.3 NOT USED.

### 3.4 INSTALLATION OF PIPE GUARDS

Pipe guards shall be set vertically in concrete piers. Piers shall be constructed of, and the hollow cores of the pipe filled with, concrete having a compressive strength of 3000 psi.

### 3.5 INSTALLATION OF DOWNSPOUT BOOTS

Downspouts shall be secured to building through integral lips with appropriate fasteners.

### 3.6 ATTACHMENT OF HANDRAILS

Toeboards and brackets shall be installed where indicated. Splices, where required, shall be made at expansion joints. Removable sections shall be installed as indicated.

#### 3.6.1 Installation of Steel Handrails

Installation shall be by expansion anchors in concrete as indicated on the drawings. or, for water storage tanks, by means of pipe sleeves secured to base plates or mounts bolted to stringers or structural steel framework. Rail ends shall be secured by steel pipe flanges anchored by expansion shields and bolts.

#### 3.6.2 Installation of Aluminum

Installation aluminum shelves and incubator racks shall be by means of flanges anchored to concrete by expansion shields, welding and flanges with through-bolts as shown on the drawings. Bolts used to anchor aluminum alloy flanges shall be stainless steel of an appropriate size and as shown on the drawings. Where aluminum or alloy fittings or extrusions are to be in contact with dissimilar metals or portland cement concrete, the contact surface shall be given a heavy coating of bituminous paint or asphalt varnish.

### 3.7 MOUNTING OF SAFETY CHAINS

Safety chains shall be mounted 3 feet 6 inches and 2 feet above the floor.

### 3.8 INSTALLATION OF SAFETY NOSINGS

Nosing shall be completely embedded in concrete before the initial set of the concrete occurs and shall finish flush with the top of the concrete surface.

### 3.9 DOOR FRAMES

Door frames shall be secured to the floor slab by means of angle clips and expansion bolts. Continuous door stops shall be welded to the frame or tap screwed with countersunk screws at no more than 18 inch centers, assuring in either case full contact with the frame. Any necessary reinforcements shall be made and the frames shall be drilled and tapped as required for hardware.

### 3.10 TRENCH FRAMES AND COVERS

Trench frames and covers shall finish flush with the floor.

3.11 INSTALLATION OF FIRE EXTINGUISHER CABINETS

Metal fire extinguisher cabinets shall be furnished and installed in accordance with NFPA 10 where shown on the drawings or specified.

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## SECTION 06100A

## ROUGH CARPENTRY

02/02

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN FOREST &amp; PAPER ASSOCIATION (AF&amp;PA)

- AF&PA T101 (1991; Supple 1993; Addenda Apr 1997; Supple T02) National Design Specification for Wood Construction
- AF&PA T11 (1988) Manual for Wood Frame Construction  
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## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM A 307 (2000) Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
- ASTM C 518 (1998) Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
- ASTM C 665 (1998) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
- ASTM E 154 (1988; R 1999) Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
- ASTM E 96 (2000) Water Vapor Transmission of Materials
- ASTM F 547 (1977; R 1995) Definitions of Terms Relating to Nails for Use with Wood and Wood-Based Materials

## AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

- AWPA C2 (2000) Lumber, Timber, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes
- AWPA C27 (1999) Plywood - Fire-Retardant Pressure Treatment
- AWPA C9 (1997) Plywood - Preservative Treatment by

## Pressure Processes

AWPA M4	(1999) Standard for the Care of Preservative-Treated Wood Products
AWPA P5	(2000) Standards for Waterborne Preservatives
APA - THE ENGINEERED WOOD ASSOCIATION (APA)	
APA E445R	(1980; Rev Jan 1996) Performance Standards and Policies for Structural-Use Panels
NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)	
NHLA Rules	(1994) Rules for the Measurement & Inspection of Hardwood & Cypress
NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)	
NELMA Grading Rules	(1997) Standard Grading Rules for Northeastern Lumber
REDWOOD INSPECTION SERVICE (RIS)	
RIS Grade Use	(1997) Grades of California Redwood Lumber
SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)	
SCMA Spec	(1986; Supple No. 1, Aug 1993) Standard Specifications for Grades of Southern Cypress
SOUTHERN PINE INSPECTION BUREAU (SPIB)	
SPIB 1003	(1994; Supple 8 thru 11) Standard Grading Rules for Southern Pine Lumber
U.S. DEPARTMENT OF COMMERCE (DOC)	
PS1	(1995) Construction and Industrial Plywood
PS2	(1993) Wood-Base Structural-Use Panels
WEST COAST LUMBER INSPECTION BUREAU (WCLIB)	
WCLIB 17	(1996; Supp. VII & VIII) Standard Grading and Dressing Rules for Douglas Fir, Western Hemlock, Western Red Cedar, White Fir, Sitka Spruce Lumber
WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)	
WWPA Grading Rules	(1999) Western Lumber Grading Rules 95

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation;

submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### SD-07 Certificates

##### Grading and Marking;

Manufacturer's certificates (approved by an American Lumber Standards approved agency) attesting that lumber and material not normally grade marked meet the specified requirements. Certificate of Inspection for grade marked material by an American Lumber Standards Committee (ALSC) recognized inspection agency prior to shipment.

##### Insulation;

Certificate attesting that the glass and fiber batt insulation and polyisocyanurate insulation furnished for the project contains recovered material, and showing an estimated percent of such recovered material.

### 1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well ventilated areas, and protected from extreme changes in temperature and humidity.

## PART 2 PRODUCTS

### 2.1 LUMBER AND SHEATHING

#### 2.1.1 Grading and Marking

##### 2.1.1.1 Lumber Products

Solid sawn and finger-jointed lumber shall bear an authorized grade stamp or grade mark recognized by ALSC, or an ALSC recognized certification stamp, mark, or hammer brand. Surfaces that are to be exposed to view shall not bear grade marks, stamps, or any type of identifying mark. Hammer marking will be permitted on lumber when all surfaces will be exposed to view.

##### 2.1.1.2 Plywood and Other Sheathing Products

Materials shall bear the grade mark or other identifying marks indicating grades of material and rules or standards under which produced, including requirements for qualifications and authority of the inspection organization. Bundle marking will not be permitted for plywood in lieu of marking each individual piece. Surfaces that are to be exposed to view shall not bear grade marks or other types of identifying marks.

##### 2.1.2 Sizes

Lumber and material sizes shall conform to requirements of the rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Unless otherwise specified, sizes indicated are nominal sizes, and actual sizes shall be within manufacturing tolerances

allowed by the standard under which the product is produced.

### 2.1.3 Treatment

Exposed areas of treated wood that are cut or drilled after treatment shall receive a field treatment in accordance with AWPA M4. Items of all-heart material of cedar, cypress, or redwood will not require preservative treatment. Except as specified for all-heart material of the previously mentioned species, the following items shall be treated:

- a. Wood members within 18 inches of soil.
- b. Wood members used in roofing systems.
- c. Wood members in contact with concrete that is in contact with soil or water or that is exposed to weather.

#### 2.1.3.1 Lumber

Lumber shall be treated in accordance with AWPA C2 with waterborne preservatives listed in AWPA P5 to a retention level as follows:

- a. 0.25 pcf intended for above ground use.

Plywood shall be treated in accordance with AWPA C9 with waterborne preservatives listed in AWPA P5 to a retention level as follows:

- a. 0.25 pcf intended for above ground use.

#### 2.1.4 Moisture Content

At the time lumber and other materials are delivered and when installed in the work their moisture content shall be as follows:

- a. Treated and Untreated Lumber : 4 inches or less, nominal thickness, 19 percent maximum.
- b. Materials Other Than Lumber: In accordance with standard under which product is produced.

#### 2.1.5 Fire-Retardant Treatment

Fire-retardant treated wood shall be pressure treated in accordance with AWPA C27 for plywood. Material use shall be defined in AWPA C27 for Interior Type. Treatment and performance inspection shall be by an independent and qualified testing agency that establishes performance ratings. Each piece or bundle of treated material shall bear identification of the testing agency to indicate performance in accordance with such rating. Items to be treated include: all plywood used in the exterior wall system utilized to support the E.I.F.S. and cultured stone exterior wall finishes, all wood blocking used in the exterior wall system, and the electrical panel boards.

#### 2.1.6 Sheathing

Sheathing shall be plywood.

##### 2.1.6.1 Plywood

Plywood shall conform to PS1, APA E445R or PS2, Grade C-D or sheathing grade with exterior glue. Sheathing for roof and walls without corner bracing of framing shall have a span rating of 16/0 or greater for supports 16 inches on center and a span rating of 24/0 or greater for supports 24 inches on center.

### 2.1.7 Miscellaneous Wood Members

#### 2.1.7.1 Nonstress Graded Members

Members shall include furring and blocking. Members shall be in accordance with TABLE I for the species used. Sizes shall be as follows unless otherwise shown:

Member	Size (inch)
Furring & Blocking	1 & 2 inch wood stock members. Lengths as shown on the drawings.

#### 2.1.7.2 Blocking

Blocking shall be standard or number 2 grade.

### 2.2 ACCESSORIES AND NAILS

Markings shall identify both the strength grade and the manufacturer. Accessories and nails shall conform to the following:

#### 2.2.1 Anchor Bolts

ASTM A 307, size as indicated, complete with nuts and washers.

#### 2.2.2 Bolts: Lag, Toggle, and Miscellaneous Bolts and Screws

Type, size, and finish best suited for intended use. Finish options include zinc compounds, cadmium, and aluminum paint impregnated finishes.

#### 2.2.3 Nails and Staples

ASTM F 547, size and type best suited for purpose; staples shall be as recommended by the manufacturer of the materials to be joined. Length of nails shall be sufficient to extend 1 inch into supports. In general, 8-penny or larger nails shall be used for nailing through 1 inch thick lumber and for toe nailing 2 inch thick lumber; 16-penny or larger nails shall be used for nailing through 2 inch thick lumber. Nails used with treated lumber and sheathing shall be galvanized. Nailing shall be in accordance with the recommended nailing schedule contained in AF&PA T11. Where detailed nailing requirements are not specified, nail size and spacing shall be sufficient to develop an adequate strength for the connection. The connection's strength shall be verified against the nail capacity tables in AF&PA T101. Reasonable judgement backed by experience shall ensure that the designed connection will not cause the wood to split.

If a load situation exceeds a reasonable limit for nails, a specialized connector shall be used.

### 2.3 INSULATION

Thermal resistance of insulation shall be not less than the R-values shown.

R-values shall be determined at 75 degrees F in accordance with ASTM C 518. Contractor shall comply with EPA requirements in conformance with Section 01670 RECYCLED / RECOVERED MATERIALS. Insulation shall be the standard product of a manufacturer and factory marked or identified with manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages. Materials containing more than one percent asbestos will not be allowed.

### 2.3.1 Batt or Blanket

#### 2.3.1.1 Glass Fiber Batts and Rolls

Glass fiber batts and rolls shall conform to ASTM C 665, Type II kraft faced insulation. Width and length shall suit construction conditions.

### 2.3.2 Sill Sealer

Mineral wool, 1 inch thick and compressible to 1/32 inch, width of sill, designed to perform as an air, dirt, and insect seal in conformance with ASTM C 665, Type I.

### 2.4 VAPOR RETARDER

Vapor retarder shall be polyethylene sheeting conforming to ASTM E 154 or other equivalent material. Vapor retarder shall have a maximum vapor permeance rating of 0.5 perms as determined in accordance with ASTM E 96, unless otherwise specified.

## PART 3 EXECUTION

### 3.1 INSTALLATION OF FRAMING

#### 3.1.1 General

General framing shall be in accordance with AF&PA T11. Members shall be closely fitted, accurately set to required lines and levels, and rigidly secured in place.

### 3.2 INSTALLATION OF SHEATHING

#### 3.2.1 Plywood

Sheathing shall be applied with edges 1/8 inch apart at side and end joints, and nailed at supported edges at 6 inches on center and at intermediate supports 12 inches on center unless otherwise shown. Nailing of edges shall be 3/8 inch from the edges. Wall sheathing shall extend over top and bottom plates, and if applied horizontally the vertical joints shall be made over supports and staggered.

### 3.3 INSTALLATION OF MISCELLANEOUS WOOD MEMBERS

#### 3.3.1 Blocking

Blocking shall be provided as necessary for application of siding, sheathing, and other materials or building items, and to provide firestopping. Blocking for firestopping shall ensure a maximum dimension of 8 feet for any concealed space. Blocking shall be cut to fit between framing members and rigidly nailed thereto.

### 3.3.2 Furring & Blocking

Furring and blocking strips shall be provided at the locations shown. Furring strips shall be installed at 16 inches on center unless otherwise shown, run in lengths as long as practicable, butt jointed and rigidly secured in place.

### 3.4 INSTALLATION OF INSULATION

Batt insulation shall be installed after construction has advanced to a point that the installed insulation will not be damaged by remaining work and protected from the weather elements. For thermal insulation the actual installed thickness shall provide the R-values shown. Insulation shall be installed on the weather side of such items as electrical boxes and water lines. Unless otherwise specified, installation shall be in accordance with the manufacturer's recommendation.

### 3.5 INSTALLATION OF VAPOR RETARDER

Vapor retarder shall be applied to provide a continuous barrier at window and door frames, and at all penetrations such as electrical outlets and switches, plumbing connections, and utility service penetrations. Joints in the vapor retarder shall be lapped and sealed according to the manufacturer's recommendations.

## 3.6 TABLES

TABLE I. SPECIES AND GRADE

## Wall Sheathing, Furring and Blocking

Grading Rules	Species	Const Standard	No. 2 Comm	No. 2 Board Comm	No. 3 Comm
NHLA Rules	Cypress			X	
NELMA Grading Rules	Northern White Cedar				X
	Eastern White Pine	X			
	Northern Pine	X			
	Balsam Fir				X
	Eastern Hemlock-Tamarack				X
RIS Grade Use	Redwood		X		
SCMA Spec	Cypress			X	
SPIB 1003	Southern Pine		X		
WCLIB 17	Douglas Fir-Larch	X			
	Hem-Fir	X			
	Sitka Spruce	X			
	Mountain Hemlock	X			
	Western Cedar	X			
WWPA Grading Rules	Douglas Fir-Larch	X			
	Hem-Fir	X			
	Idaho White Pine	X			
	Lodgepole Pine			X	
	Ponderosa Pine			X	
	Sugar Pine			X	
	Englemann Spruce			X	
	Douglas Fir South			X	
	Mountain Hemlock			X	
	Subalpine Fir			X	
	Western Cedar			X	

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## SECTION 06200A

## FINISH CARPENTRY

11/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM F 547 (1977; R 1995) Definitions of Terms  
Relating to Nails for Use with Wood and  
Wood-Based Materials

## NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA Grading Rules (1997) Standard Grading Rules for  
Northeastern Lumber

## REDWOOD INSPECTION SERVICE (RIS)

RIS Grade Use (1987) Grades of California Redwood Lumber

## SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)

SCMA Spec (1986; Supple No. 1, Aug 1993) Standard  
Specifications for Grades of Southern  
Cypress

## SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB 1003 (1994; Supple 8 thru 11) Standard Grading  
Rules for Southern Pine Lumber

## WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB 17 (1996; Supples VII(A-E), VIII(A-C))  
Grading Rules for West Coast Lumber

## WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA Grading Rules (1999) Western Lumber Grading Rules 95

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

## Finish Carpentry; G-DO

Drawings showing fabricated items and special mill and woodwork items. Drawings shall indicate materials and details of construction, methods of fastening, erection, and installation.

## SD-04 Samples

## Bulletin Board Finishes; G-DO

## Moldings &amp; Trim; G-DO

Samples shall be of sufficient size to show patterns, color ranges, and types, as applicable, of the material proposed to be used. Provide three samples of each.

## 1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well-ventilated areas, and protected from extreme changes in temperature and humidity.

## PART 2 PRODUCTS

## 2.1 WOOD ITEMS AND TRIM

The Contractor shall furnish products which optimize design by reducing the amount of wood used (engineered wood), by using recycled wood products and preservatives without arsenic or chromium when the products and methods are competitive in price or directed by the Contracting Officer. The Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS.

## 2.1.1 Grading and Marking

Materials shall bear the grade mark, stamp or other identifying marks indicating grades of material and rules or standards under which produced. Such identifying marks on a material shall be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification. The inspection agency for lumber shall be certified by the Board of Review, American Lumber Standards Committee, to grade the species used. Except for plywood, wood structural panels, and lumber, bundle marking will be permitted in lieu of marking each individual piece. Surfaces that are to be architecturally exposed to view shall not bear grade marks, stamps, or other types of identifying marks.

## 2.1.2 Sizes and Patterns

Lumber sizes and patterns shall conform to rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Sizes and patterns for materials other than lumber shall conform to requirements of the rules or standards under which produced. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

### 2.1.3 Moisture Content

The maximum moisture content of untreated trim and wood siding shall be 15 percent at the time of delivery to the jobsite and when installed. Moisture content of all other material shall be in accordance with the standard under which the product is produced.

### 2.1.4 Moldings and Trim

Moldings and trim millwork items shall be of the pattern indicated and shall be of a grade compatible with the finish specified.

### 2.1.5 Woodwork Items

#### 2.1.5.1 Bulletin Boards

Bulletin boards shall have a satin anodized aluminum frame with a 1-1/2" (width) x 2" (depth) red oak hardwood outer frame, 1/4 inch thick plywood or hardboard back; and a 1/4 inch thick, dense, a wheat colored woven fabric cover over a smooth faced cork board face securely cemented to the hardboard back. A satin anodized aluminum hinged door with an 1/8" tempered glass. Bulletin board shall be similar to a Nelson-Harkins, Model 262 Series (1-800-882-8989) or equal.

#### 2.1.5.2 Utility Shelving

Utility shelving shall be a suitable species equal to or exceeding requirements of No. 3 Common white fir under WWPA Grading Rules, 1 inch thick; or plywood, interior type, Grade A-B, 3/4 inch thick, any species group.

## 2.2 NAILS

Nails shall be the size and type best suited for the purpose and shall conform to ASTM F 547. Nails shall be hot-dip galvanized or aluminum when used on exterior work. For siding, length of nails shall be sufficient to extend 1-1/2 inches into supports, including wood sheathing over framing. Screws for use where nailing is impractical shall be size best suited for purpose.

## PART 3 EXECUTION

### 3.1 GENERAL

### 3.2 MOLDING AND INTERIOR TRIM

Molding and interior trim shall be installed straight, plumb, level and with closely fitted joints. Exposed surfaces shall be machine sanded at the mill. Molded work shall be coped at returns and interior angles and mitered at external corners. Intersections of flatwork shall be shouldered to ease any inherent changes in plane. Trim shall be provided in single lengths when practical. Blind nailing shall be used to the extent practicable, and face nailing shall be set and stopped with a nonstaining putty to match the finish applied. Screws shall be used for attachment to metal; setting and stopping of screws shall be of the same quality as required where nails are used.

### 3.3 WOODWORK ITEMS

### 3.3.1 Bulletin Boards

Items shall be installed in accordance with the manufacturer's recommendation.

### 3.3.2 Shelving

Shelving shall be anchored to supporting construction. Unless otherwise indicated, shelves shall be supported by wall-supported brackets not more than 24 inches on center or as required to limit deflection to 1/4 inch between supports with a load of 35 lb per lineal foot. Adjustable shelf hardware shall be steel standards, channel shaped, with 1 inch adjustment slots and brackets designed for attachment to standards.

### 3.3.3 Clothes Hanger Rods

Rods shall be provided where indicated and in all closets having hook strips. Rods shall be aluminum pipe or tubing 1 inch in diameter. Rods shall be set parallel with the front edges of the shelving, and shall be supported at each end by suitable sockets, and by intermediate brackets spaced at not more than 4 foot centers.

## 3.4 TABLES

TABLE I. SPECIES AND GRADE TABLES

Grading Rules	Species	Choice	Clear	C Select	C & Better
NELMA Grading Rules					
	Red Oak	X			
	Eastern Hemlock		X		
	Tamarack				X
	Eastern W. Pine				X
	Northern Pine				X
	Eastern Spruce			X	
	Balsam Fir		X		
RIS Grade Use	Redwood		X		
SCMA Spec	Cypress			X	
SPIB 1003	Southern Pine				X
WCLIB 17	Douglas Fir				X
	Larch				X
	Hemlock Fir				X
	Mountain Hemlock				X
	Sitka Spruce				X
WWPA Grading Rules					
	Red Oak	X			
	Douglas Fir				X
	Larch				X
	Hemlock Fir		X		
	Mountain Hemlock				X
	Western Larch		X		
	Idaho White Pine	X			
	Lodgepole Pine		X		
	Ponderosa Pine		X		
	Sugar Pine		X		
	Englemann Spruce		X		
	Douglas Fir South		X		
	Subalpine Fir		X		

NOTE 1: Interior trim shall be red oak and the highest grade of the species for stain or natural finish . Utility shelving shall be any of the species listed above.

-- End of Section --

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## SECTION 06410A

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**11/01**

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## SECTION 06410A

## ARCHITECTURAL CASEWORK

11/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A161.2 (1998) Decorative Laminate Countertops,  
Performance Standards for Fabricated High  
Pressure

ANSI A208.1 (1999) Particleboard Mat Formed Woods

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1037 (1999) Evaluating Properties of Wood-Base  
Fiber and Particle Panel Materials

ASTM F 547 (1977; R 1995) Definitions of Terms  
Relating to Nails for Use with Wood and  
Wood-Based Materials

## ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI Qual Stds (1999) Architectural Woodwork Quality  
Standards

## BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA A156.9 (1994) Cabinet Hardware

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA LD 3 (1995) High-Pressure Decorative Laminates

NEMA LD 3.1 (1995) Performance, Application,  
Fabrication, and Installation of  
High-Pressure Decorative Laminates

## WINDOW AND DOOR MANUFACTURERS ASSOCIATION (WDMA)

WDMA I.S. 1-A (1997) Architectural Wood Flush Doors

## 1.2 GENERAL DESCRIPTION

Work in this section includes laminate clad custom casework cabinets as shown on the drawings and as described in this specification. Also,

included in this Section is high-pressure laminate surfacing and cabinet hardware. The Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS. All exposed and semi-exposed surfaces, whose finish is not otherwise noted on the drawings or finish schedule, shall be sanded smooth and shall receive a clear finish of polyurethane. Wood finish may be shop finished or field applied in accordance with Section 09900 PAINTING, GENERAL.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. All items designated with a "G", including product literature, calculations, component data, certificates, diagrams, drawings, and samples shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES.

#### SD-02 Shop Drawings

Shop Drawings; G-DO  
Installation; G-AO

Shop drawings showing all fabricated casework items in plan view, elevations and cross-sections to accurately indicate materials used, details of construction, dimensions, methods of fastening and erection, and installation methods proposed. Shop drawing casework items shall be clearly cross-referenced to casework items located on the project drawings. Shop drawings shall include a color schedule of all casework items to include all countertop, exposed, and semi-exposed cabinet finishes to include finish material manufacturer, pattern, and color.

#### SD-03 Product Data

Wood Materials; G-DO  
Wood Finishes; G-DO  
Finish Schedule; G-DO

Descriptive data which provides narrative written verification of all types of construction materials and finishes, methods of construction, etc. not clearly illustrated on the submitted shop drawings. Data shall provide written verification of conformance with AWI Qual Stds for the quality indicated to include materials, tolerances, and types of construction. Both the manufacturer of materials and the fabricator shall submit available literature which describes re-cycled product content, operations and processes in place that support efficient use of natural resources, energy efficiency, emissions of ozone depleting chemicals, management of water and operational waste, indoor environmental quality, and other production techniques supporting sustainable design and products.

## SD-04 Samples

## Plastic Laminates; G-DO

Two samples of each plastic laminate pattern and color. Samples shall be a minimum of 5 by 7 inches in size.

## Cabinet Hardware; G-DO

One sample of each cabinet hardware item specified to include hinges, pulls, shelving supports and drawer glides.

## Red Oak Plywood Veener; G-DO

Two samples. Samples shall be a minimum of 5 by 7 inches in size.

## SD-07 Certificates

## Quality Assurance;

A quality control statement which illustrates compliance with and understanding of AWI Qual Stds requirements, in general, and the specific AWI Qual Stds requirements provided in this specification. The quality control statement shall also certify a minimum of ten years contractor's experience in laminate clad casework fabrication and construction. The quality control statement shall provide a list of a minimum of five successfully completed projects of a similar scope, size, and complexity.

## 1.4 QUALITY ASSURANCE

Unless otherwise noted on the drawings, all materials, construction methods, and fabrication shall conform to and comply with the premium grade quality standards as outlined in AWI Qual Stds, Section 400G and Section 400B for laminate clad cabinets. These standards shall apply in lieu of omissions or specific requirements in this specification. Contractors and their personnel engaged in the work shall be able to demonstrate successful experience with work of comparable extent, complexity and quality to that shown and specified. Contractor must demonstrate knowledge and understanding of AWI Qual Stds requirements for the quality grade indicated.

## 1.5 CABINETS

Wall and base cabinets shall be of the same construction and same outside appearance. General cabinet design is a reveal overlay construction. All exposed and semi-exposed surfaces not otherwise noted on the drawings or specified, shall have finishes matching "highest grade" adjacent cabinet surfaces. Door design shall be solid flush face from vendors standard styles. Corner cabinet unit shelving shall be as specified in Hardware paragraph.

## 2.1.1 Frame Type Cabinets

The cabinets shall be constructed with frame fronts and solid ends, or frame construction throughout. Frame members shall be 3/4 inch thick by 1-1/2 inch wide; kiln-dried hardwood, glued together, and shall be either mortised and tenoned, dovetailed or doweled, nailed, stapled or screwed. Top and bottom corners shall be braced with either hardwood blocks that are

glued together with water resistant glue and nailed in place, or metal or plastic corner braces. Backs of wall cabinets shall be 1/4 inch thick, red oak veneer hardwood plywood. Backs of base and tall cabinets shall be 3/8 inch thick hardwood or 3/8 inch thick, red oak veneer hardwood plywood. Bottoms of cabinets shall be minimum 3/4 inch thick red oak veneer red oak hardwood plywood. Cabinet ends shall be 5/8 inch thick red oak veneer hardwood plywood (where natural finish is indicated) and 5/8 inch thick, 45 pound density particle board core (where plastic laminate finish is indicated).

#### 1.6 DELIVERY AND STORAGE

Casework may be delivered knockdown or fully assembled. All units shall be delivered to the site in undamaged condition, stored off the ground in fully enclosed areas, and protected from damage. The storage area shall be well ventilated and not subject to extreme changes in temperature or humidity.

#### 1.7 SEQUENCING AND SCHEDULING

Work shall be coordinated with other trades. Units shall not be installed in any room or space until painting, and ceiling installation are complete within the room where the units are located. Floor cabinets shall be installed before finished flooring materials are installed.

#### 1.8 PROJECT/SITE CONDITIONS

Field measurements shall be verified as indicated in the shop drawings before fabrication.

### PART 2 PRODUCTS

#### 2.1 WOOD MATERIALS

##### 2.1.1 Lumber

All framing lumber shall be kiln-dried Grade III to dimensions as shown on the drawings. Frame front, where indicated on the drawings, shall be nominal 3/4 inch hardwood.

##### 2.1.1.1 Standing and Running Trim

Standing or running trim casework components which are specified to receive a transparent finish shall be red oak hardwood species, plain sawn. AWI grade shall be premium. Location, shape, and dimensions shall be as indicated on the drawings.

##### 2.1.2 Panel Products

##### 2.1.2.1 Plywood

All plywood panels used for framing purposes shall be veneer core hardwood plywood, AWI Qual Stds Grade AA. Nominal thickness of plywood panels shall be as indicated in this specification and on the drawings.

##### 2.1.2.2 Particleboard

All particleboard shall be industrial grade, medium density (40 to 50 pounds per cubic foot), 3/4 inch thick. Particleboard shall meet the

minimum standards listed in ASTM D 1037 and ANSI A208.1.

## 2.2 SOLID POLYMER MATERIAL

Solid surfacing casework components shall conform to the requirements of Section 06650 SOLID POLYMER FABRICATIONS.

## 2.3 HIGH PRESSURE DECORATIVE LAMINATE (HPDL)

All plastic laminates shall meet the requirements of NEMA LD 3 and ANSI A161.2 for high-pressure decorative laminates. Design, colors, surface finish and texture, and locations shall be as indicated on Section 09915 COLOR SCHEDULE. Plastic laminate types and nominal minimum thicknesses for casework components shall be as indicated in the following paragraphs.

### 2.3.1 Horizontal General Purpose Standard (HGS) Grade

Horizontal general purpose standard grade plastic laminate shall be 0.048 inches (plus or minus 0.005 inches) in thickness. This laminate grade is intended for horizontal surfaces where post forming is not required.

### 2.3.2 Vertical General Purpose Standard (VGS) Grade

Vertical general purpose standard grade plastic laminate shall be 0.028 inches (plus or minus 0.004 inches) in thickness. This laminate grade is intended for exposed exterior vertical surfaces of casework components where post forming is not required.

### 2.3.3 Cabinet Liner Standard (CLS) Grade

Cabinet liner standard grade plastic laminate shall be 0.020 inches in thickness. This laminate grade is intended for light duty semi-exposed interior surfaces of casework components.

### 2.3.4 Backing Sheet (BK) Grade

Undecorated backing sheet grade laminate is formulated specifically to be used on the backside of plastic laminated panel substrates to enhance dimensional stability of the substrate. Backing sheet thickness shall be 0.020 inches. Backing sheets shall be provided for all laminated casework components where plastic laminate finish is applied to only one surface of the component substrate.

## 2.4 THERMOSET DECORATIVE OVERLAYS (MELAMINE)

Thermoset decorative overlays (melamine panels) shall be used for casework cabinet interior, drawer interior, and all semi-exposed surfaces.

## 2.5 EDGE BANDING

Edge banding for casework doors and drawer fronts shall be PVC vinyl and shall be 0.020 inch thick. Material width shall be as indicated on the drawings. Color and pattern shall match exposed door and drawer front laminate pattern and color.

## 2.6 CABINET HARDWARE

All hardware shall conform to BHMA A156.9, unless otherwise noted, and shall consist of the following components:

- a. Door Hinges: (180 deg.) frameless concealed type, BHMA No. B01602.
- b. Cabinet Door Pulls: Back mounted pull type, BHMA No. B02131.
- c. Cabinet Drawer Pulls: Back mounted pull type, BHMA No. B02011.
- d. Cabinet Door Catch: Magnetic catch type, BHMA No. B03141.
- e. Drawer Slide: Side mounted type, BHMA No. B05051 with full extension and a minimum 75 pound load capacity. Slides shall include an integral stop to avoid accidental drawer removal.
- f. Adjustable Shelf Support System: Recessed (mortised) metal standards, BHMA No. B04071. Support clips for the standards shall be open type, BHMA No. B04091, metal supports.
- g. Display Cabinet Hardware System: Sliding glass doors shall be mounted on aluminum frames with ball bearing rollers and aluminum frame guides. Doors shall be secured with a removable keyed door lock. See AARCO Products Inc. (1-800-246-6038) for described hardware features.
- h. Cabinet Corner Unit Shelving ("Lazy Susan"): Rotating Shelves-Full Round type, BHMA No. B06011.

## 2.7 FASTENERS

Nails, screws, and other suitable fasteners shall be the size and type best suited for the purpose and shall conform to ASTM F 547 where applicable.

## 2.8 ADHESIVES, CAULKS, AND SEALANTS

### 2.8.1 Adhesives

Adhesives shall be of a formula and type recommended by AWI. Adhesives shall be selected for their ability to provide a durable, permanent bond and shall take into consideration such factors as materials to be bonded, expansion and contraction, bond strength, fire rating, and moisture resistance. Adhesives shall meet local regulations regarding VOC emissions and off-gassing.

#### 2.8.1.1 Wood Joinery

Adhesives used to bond wood members shall be a Type II for interior use urea-formaldehyde resin formula. Adhesives shall withstand a bond test as described in WDMA I.S. 1-A.

#### 2.8.1.2 Laminate Adhesive

Adhesive used to join high-pressure decorative laminate to wood shall be a water-based contact adhesive. PVC edge banding shall be adhered using a polymer-based hot melt glue.

### 2.8.2 Caulk

Caulk used to fill voids and joints between laminated components and between laminated components and adjacent surfaces shall be clear, 100 percent silicone.

### 2.8.3 Sealant

Sealant shall be of a type and composition recommended by the substrate manufacturer to provide a moisture barrier at sink cutouts and all other locations where unfinished substrate edges may be subjected to moisture.

## 2.9 WOOD FINISHES

Paint, stain, varnish and their applications required for exposed wood cabinet finishes shall be as indicated in Section 09900 PAINTING, GENERAL. Color and location shall be as indicated in Section 09915.

## 2.10 ACCESSORIES

### 2.10.1 Glass and Glazing

Tempered glass is required in casework in accordance with Section 08810A GLASS AND GLAZING.

## 2.11 FABRICATION

Fabrication and assembly of components shall be accomplished at the shop site to the maximum extent possible. Construction and fabrication of cabinets and their components shall meet or exceed the requirements for AWI premium grade unless otherwise indicated in this specification. Cabinet style, in accordance with AWI Qual Stds, Section 400-G descriptions, shall be reveal overlay as indicated on the drawings.

### 2.11.1 Base and Wall Cabinet Case Body

Frame members shall be glued-together, kiln-dried hardwood lumber. Top corners, bottom corners, and cabinet bottoms shall be braced with either hardwood blocks or water-resistant glue and nailed in place metal or plastic corner braces. Cabinet components shall be constructed from the following materials and thicknesses:

- a. Body Members (Ends, Divisions, Bottoms, and Tops): 3/4 inch veneer core plywood panel product.
- b. Face Frames and Rails: 3/4 inch hardwood lumber. 3/4-inch plywood red oak veneer panel product at wood finish locations.
- c. Shelving: 3/4 inch veneer core plywood panel product.
- d. Cabinet Backs: 1/4 inch veneer core plywood panel product.
- e. Drawer Sides, Backs, and Subfronts: 1/2 inch hardwood lumber panel product.
- f. Drawer Bottoms: 1/4 inch particleboard panel product.
- g. Door and Drawer Fronts: 3/4-inch particleboard panel product at plastic laminate finish locations and 3/4-inch plywood red oak veneer panel product at wood finish locations.

#### 2.11.1.1 Joinery Method for Case Body Members

- a. Tops, Exposed Ends, and Bottoms. Contractor shall select one of the following methods for construction:

- 1) Steel "European" assembly screws (1-1/2 inch from end, 5 inch on center, fasteners will not be visible on exposed parts).
- 2) Doweled, glued under pressure (approx. 4 dowels per 12 inches of joint).

b. Exposed End Corner and Face Frame Attachment. Contractor shall select one of the following methods for construction:

- 1) For mitered joint: lock miter or spline or biscuit, glued under pressure (no visible fasteners).
- 2) For non-mitered joint (90 degree): butt joint glued under pressure (no visible fasteners).

c. Cabinet Backs (Wall Hung Cabinets): Wall hung cabinet backs must not be relied upon to support the full weight of the cabinet and its anticipated load for hanging/mounting purposes. Method of back joinery and hanging/mounting mechanisms should transfer the load to case body members. Contractor shall have the fabrication option of using one of the following methods. The Contractor's selected method shall be use throughout the cabinet construction:

- 1) Full bound, captured in grooves on cabinet sides, top, and bottom. Cabinet backs for floor standing cabinets shall be side bound, captured in grooves; glued and fastened to top and bottom.
- 2) Full overlay, plant-on backs with minimum back thickness of 1/2 inch and minimum No. 12 plated (no case hardened) screws spaced a minimum 3 inches on center. Edge of back shall not be exposed on finished sides. Anchor strips are not required when so attached.

d. Cabinet Backs (Floor Standing Cabinets). Contractor shall select one of the following methods for construction:

- 1) Side bound, captured in grooves; glued and fastened to top and bottom.
- 2) Full overlay, plant-on backs with minimum back thickness of 1/2 inch and minimum No. 12 plated (no case hardened) screws spaced a minimum 3 inches on center. Edge of back shall not be exposed on finished sides. Anchor strips are not required when so attached.

e. Wall Anchor Strips shall be required for all cabinets with backs less than 1/2 inch thick. Strips shall consist of minimum 1/2 inch thick lumber, minimum 2-1/2 inches width; securely attached to wall side of cabinet back - top and bottom for wall hung cabinets, top only for floor standing cabinets.

#### 2.11.2 Cabinet Floor Base

Floor cabinets shall be mounted on a base constructed of nominal 2 inch thick lumber. Base assembly components shall be treated lumber. Finished height for each cabinet base shall be as indicated on the drawings. Bottom edge of the cabinet door or drawer face shall be as indicated on the drawings.

#### 2.11.3 Cabinet Door and Drawer Fronts

Door and drawer fronts shall be fabricated from 3/4 inch medium density particleboard. All door and drawer front edges shall be surfaced with PVC edge banding, color and pattern as indicated in Section 09915 COLOR SCHEDULE.

#### 2.11.4 Drawer Assembly

Drawer components shall consist of a removable drawer front, sides, backs, and bottom. Drawer components shall be constructed of the following materials and thicknesses:

- a. Drawer Sides and Back For Thermoset Decorative Overlay (melamine) Finish: 1/2 inch thick medium density particleboard or MDF fiberboard substrate.
- b. Drawer Bottom: 1/4 inch thick thermoset decorative overlay melamine panel product.

##### 2.11.4.1 Drawer Assembly Joinery Method

- a. Multiple dovetail (all corners) or French dovetail front/dadoed back, glued under pressure.

#### 2.11.5 Shelving

Shelving shall be fabricated from 3/4 inch veneer core plywood. All shelving top and bottom surfaces shall be finished. Shelf edges shall be finished with a continuous hardwood edge strip.

##### 2.11.5.1 Shelf Support System

The shelf support system shall be:

- a. Recessed (mortised) metal shelf standards. Standards shall be mortised flush with the finishes surface of the cabinet interior side walls, two per side. Standards shall be positioned and spaced on the side walls to provide a stable shelf surface that eliminates tipping when shelf front is weighted. Standards shall be installed and adjusted vertically to provide a level, stable shelf surface when clips are in place.

#### 2.11.6 Laminate Application

Laminate application to substrates shall follow the recommended procedures and instructions of the laminate manufacturer and NEMA LD 3.1, using tools and devices specifically designed for laminate fabrication and application.

Provide a balanced backer sheet (Grade BK) wherever only one surface of the component substrate requires a plastic laminate finish. Apply required grade of laminate in full uninterrupted sheets consistent with manufactured sizes using one piece for full length only, using adhesives specified herein or as recommended by the manufacturer. Fit corners and joints hairline. All laminate edges shall be machined flush, filed, sanded, or buffed to remove machine marks and eased (sharp corners removed). Clean up at easing shall be such that no overlap of the member eased is visible. Fabrication shall conform to NEMA LD 3.1 and ANSI A161.2. Laminate types and grades for component surfaces shall be as follows unless otherwise indicated on the drawings:

## a. Base/Wall Cabinet Case Body.

1) Exterior (exposed) surfaces to include exposed and semi-exposed face frame surfaces: HPDL Grade VGS.

## b. Doors and Drawer Fronts.

1) Exterior (exposed) and interior (semi-exposed) faces: HPDL Grade VGS

2) Edges: PVC edge banding.

## c. Drawer Assembly.

1) All interior surfaces: Thermoset Decorative Overlay (melamine).

## d. Countertops and Splashes.

1) See SECTION: 06650 SOLID POLYMER (SOLID SURFACING) and EXPOY RESIN FABRICATIONS

## e. Glass Shelving

1) Display case glass shelving shall be clear, 3/16 inch tempered glass- See SECTION: 08810A GLASS AND GLAZING

## 2.11.6.1 Tolerances

Flushness, flatness, and joint tolerances of laminated surfaces shall meet the AWI Qual Stds premium grade requirements.

## 2.11.7 Finishing

## 2.11.7.1 Filling

No fasteners shall be exposed on laminated surfaces. All nails, screws, and other fasteners in non-laminated cabinet components shall be countersunk and the holes filled with wood filler consistent in color with the wood species.

## 2.11.7.2 Sanding

All surfaces requiring coatings shall be prepared by sanding with a grit and in a manner that scratches will not show in the final system.

## 2.11.7.3 Coatings

Types, method of application and location of casework finishes shall be in accordance with the finish schedule, drawings and Section 09900 PAINTING, GENERAL. All cabinet reveals shall be painted.

## PART 3 EXECUTION

## 3.1 INSTALLATION

Installation shall comply with applicable requirements for AWI Qual Stds premium quality standards. Countertops and fabricated assemblies shall be installed level, plumb, and true to line, in locations shown on the drawings. Cabinets and other laminate clad casework assemblies shall be attached and anchored securely to the floor and walls with mechanical

fasteners that are appropriate for the wall and floor construction.

### 3.1.1 Anchoring Systems

#### 3.1.1.1 Floor

Base cabinets shall utilize a floor anchoring system. Anchoring and mechanical fasteners shall not be visible from the finished side of the casework assembly. Cabinet assemblies shall be attached to anchored bases without visible fasteners. Where assembly abutts a wall surface, anchoring shall include a minimum 1/2 inch thick lumber or panel product hanging strip, minimum 2-1/2 inch width; securely attached to the top of the wall side of the cabinet back.

#### 3.1.1.2 Wall

Cabinets and vanities to be wall mounted shall utilize minimum 1/2 inch thick lumber or panel product hanging strips, minimum 2-1/2 inch width; securely attached to the wall side of the cabinet back, both top and bottom.

### 3.1.2 Countertops

Countertops shall be a solid surfacing material or an epoxy resin material, where shown on the drawings. See SECTION: 06650 SOLID POLYMER (SOLID SURFACING) and EPOXY RESIN FABRICATIONS for additional information.

### 3.1.3 Hardware

Casework hardware shall be installed in types and locations as indicated on the drawings. Where fully concealed European-style hinges are specified to be used with particleboard or fiberboard doors, the use of plastic or synthetic insertion dowels shall be used to receive 3/16 inch "Euroscrews". The use of wood screws without insertion dowels is prohibited.

### 3.1.4 Doors and Drawers

The fitting of doors and drawers shall be accomplished within target fitting tolerances for gaps and flushness in accordance with AWI Qual Stds premium grade requirements.

### 3.1.5 Plumbing Fixtures

Sinks, sink hardware, and other plumbing fixtures shall be installed in locations as indicated on the drawings and in accordance with Section 15400A PLUMBING, GENERAL PURPOSE.

### 3.1.6 Glass

Glass and glazing shall be installed in the casework using methods and materials specified in Section 08810A GLASS AND GLAZING in locations as indicated on the drawings.

-- End of Section --

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SECTION 06650

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## SECTION 06650

SOLID POLYMER (SOLID SURFACING) and EPOXY RESIN FABRICATIONS  
10/00

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A136.1	(1992) Organic Adhesives for Installation of Ceramic Tile
ANSI Z124.3	(1995) Plastic Lavatories
ANSI Z124.6	(1997) Plastic Sinks

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 570	(1998) Water Absorption of Plastics
ASTM D 638	(1999) Tensile Properties of Plastics
ASTM D 696	(1998) Coefficient of Linear Thermal Expansion of Plastics Between Minus 30 degrees C and 30 degrees C
ASTM D 2583	(1995) Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
ASTM E 84	(1999) Surface Burning Characteristics of Building Materials
ASTM G 21	(1996) Determining Resistance of Synthetic Polymeric Materials to Fungi
ASTM G 22	(1976; R 1996) Determining Resistance of Plastics to Bacteria

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA LD 3	(1995) High Pressure Decorative Laminates
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1.2 GENERAL DESCRIPTION

Work in this section includes and other items utilizing solid polymer (solid surfacing) fabrication as shown on the drawings and as described in this specification.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

Shop Drawings; G-DO  
Installation; G-AO

Shop Drawings indicating locations, dimensions, component sizes, fabrication and joint details, attachment provisions, installation details, and coordination requirements with adjacent work.

#### SD-03 Product Data

Solid polymer material; G-DO  
Epoxy Resin material; G-DO  
Qualifications; G-AO  
Fabrications; G-AO

Product data indicating product description, fabrication information, and compliance with specified performance requirements for solid polymer and epoxy resin materials, joint adhesive, sealants, and heat reflective tape. Both the manufacturer of materials and the fabricator shall submit a detailed description of operations and processes in place that support efficient use of natural resources, energy efficiency, emissions of ozone depleting chemicals, management of water and operational waste, indoor environmental quality, and other production techniques supporting sustainable design and products.

#### SD-04 Samples

Material; G-DO

A minimum two (2) 4 by 4 inch sample for the solid polymer and epoxy resin material types of each color and pattern for approval. Samples shall indicate full range of color and pattern variation. Approved samples shall be retained as a standard for this work.

Counter and Vanity Tops; G-DO

A minimum 1 foot wide by 6 inch deep, full size sample for each type of counter top shown on the project drawings. The sample shall include the edge profile and backsplash as detailed on the project drawings. Solid polymer material shall be of a pattern and color as indicated on the drawings. Sample shall include at least one seam. Approved sample shall be retained as standard for this work.

#### SD-06 Test Reports

Solid polymer material;  
Epoxy Resin material;

Test report results from an independent testing laboratory attesting that each of these countertop type material meets or

exceeds each of the specified performance requirements.

#### SD-07 Certificates

Fabrications;  
Qualifications;

Solid polymer and epoxy resin manufacturer's certification attesting to fabricator qualification approval.

#### SD-10 Operation and Maintenance Data

Solid polymer and epoxy resin material;  
Clean-up;

A minimum of six copies of maintenance data indicating manufacturer's care, repair and cleaning instructions. Maintenance video shall be provided, if available. Maintenance kit for matte finishes shall be submitted.

### 1.4 DELIVERY, STORAGE AND HANDLING

Materials shall not be delivered to project site until areas are ready for installation. Materials shall be stored indoors and adequate precautions taken to prevent damage to finished surfaces. Protective coverings shall be provided to prevent physical damage or staining following installation, for duration of project.

### 1.5 WARRANTY

Manufacturer's warranty of ten years against defects in materials, excluding damages caused by physical or chemical abuse or excessive heat, shall be provided. Warranty shall provide for material and labor for replacement or repair of defective material for a period of ten years after component installation.

### 1.6 QUALIFICATIONS

To insure warranty coverage, solid polymer fabricators shall be certified to fabricate by the solid polymer material manufacturer being utilized. All fabrications shall be marked with the fabricator's certification label affixed in an inconspicuous location. Fabricators shall have a minimum of 5 years of experience working with solid polymer materials.

## PART 2 PRODUCTS

### 2.1 MATERIAL

Solid polymer material shall be a homogeneous filled solid polymer; not coated, laminated or of a composite construction; meeting ANSI Z124.3 and ANSI Z124.6 requirements. Material shall have minimum physical and performance properties specified. Superficial damage to a depth of 0.01 inch shall be repairable by sanding or polishing. Material thickness shall be as indicated on the drawings. In no case shall material be less than 1/4 inch in thickness.

#### 2.1.1 Cast, 100 Percent Acrylic Polymer Solid Surfacing Material

Cast, 100 percent acrylic solid polymer material shall be composed of

acrylic polymer, mineral fillers, and pigments and shall meet the following minimum performance requirements:

PROPERTY	REQUIREMENT (min. or max.)	TEST PROCEDURE
Tensile Strength	5800 psi (min.)	ASTM D 638
Hardness	55-Barcol Impressor (min.)	ASTM D 2583
Thermal Expansion	.000023 in/in/F (max.)	ASTM D 696
Boiling water Surface Resistance	No Change	NEMA LD 3-3.05
High Temperature Resistance	No Change	NEMA LD 3-3.06
Impact Resistance (Ball drop)		NEMA LD 3-303
1/4" sheet	36", 1/2 lb ball, no failure	
1/2" sheet	140", 1/2 lb ball, no failure	
3/4" sheet	200", 1/2 lb ball, no failure	
Mold & Mildew Growth	No growth	ASTM G 21
Bacteria Growth	No Growth	ASTM G 22
Liquid Absorption (Weight in 24 hrs.)	0.1% max.	ASTM D 570
Flammability		ASTM E 84
Flame Spread	25 max.	
Smoke Developed	30 max	

#### 2.1.2 Material Patterns and Colors

Patterns and colors for all solid polymer components and fabrications shall be those indicated in SECTION: 09915 COLOR SCHEDULE.

#### 2.1.3 Surface Finish

Exposed finished surfaces and edges shall receive a uniform appearance. Exposed surface finish shall be matte; gloss rating of 5-20.

#### 2.2 Epoxy Resin Countertops and Bowls

Epoxy resin countertops shall be 1 1/4" thick, are a monolithic work

surface, capable of resisting chemical stains and deteriorations. Countertop surfaces shall be fabricated in a two-stage curing process resulting in a uniform quality, extremely durable and highly chemical resistant surface.

Countertop shall have the following features:

- a. continuous 1/8-inch beveled edge.
- b. 4" backsplashes may be supplied loose for field application.
- c. longest practical lengths, will allow seamless joints.

Physical Properties:

Compressive Strength	ASTM D695	36,500 psi
Flexural Strength	ASTM D790	16,000 psi
Tensile Strength	ASTM D638	10,500 psi
Density	ASTM D792	123.55 lbs/ft <sup>3</sup>
Rockwell M Hardness	ASTM D785	110
Heat Distortion (temp @ 264 psi)	ASTM D648	350 F
Thermal Coefficient of Exp.	ASTM D696	1.509 x 10 <sup>-5</sup> in./A deg F
Fire Resistance	ASTM D635	Self Extinguishing
Water Absorption	ASTM D570	0.0076%

Countertops shall be as manufactured by United Lab Equipment, Inc. (1-800-548-7426) or approved equal meeting the minimum performance requirements. Epoxy resin countertop and epoxy resin bowls, integral with the countertop shall be provided as shown on the drawings. Countertop shall be black color. Sink bowl sizes shall be as specified in SECTION: 15400A.

## 2.3 ACCESSORY PRODUCTS

Accessory products, as specified below, shall be manufactured by the solid polymer manufacturer or shall be products approved by the solid polymer manufacturer for use with the solid polymer materials being specified.

### 2.3.1 Seam Adhesive

Seam adhesive shall be a two-part adhesive kit to create permanent, inconspicuous, non-porous, hard seams and joints by chemical bond between solid polymer materials and components to create a monolithic appearance of the fabrication. Adhesive shall be approved by the solid polymer manufacturer. Adhesive shall be color-matched to the surfaces being bonded where solid-colored, solid polymer materials are being bonded together. The seam adhesive shall be clear or color matched where particulate patterned, solid polymer materials are being bonded together.

### 2.3.2 Panel Adhesive

Panel adhesive shall be neoprene based panel adhesive meeting ANSI A136.1, Underwriter's Laboratories (UL) listed. This adhesive shall be used to bond solid polymer components to adjacent and underlying substrates.

### 2.3.3 Silicone Sealant

Sealant shall be a mildew-resistant, FDA and UL listed silicone sealant or caulk in a clear formulation. The silicone sealant shall be approved for use by the solid polymer manufacturer. Sealant shall be used to seal all expansion joints between solid polymer components and all joints between solid polymer components and other adjacent surfaces such as walls, and

plumbing fixtures.

#### 2.3.4 Conductive Tape

Conductive tape shall be manufacturer's standard foil tape, 4 mils thick, applied around the edges of cut outs containing hot or cold appliances.

### 2.4 FABRICATIONS

Components shall be factory or shop fabricated to the greatest extent practical to sizes and shapes indicated, in accordance with approved Shop Drawings and manufacturer's requirements. Factory cutouts shall be provided for sinks, lavatories, and plumbing fixtures where indicated on the drawings. Contours and radii shall be routed to template, with edges smooth. Defective and inaccurate work will be rejected.

#### 2.4.1 Joints and Seams

Joints and seams shall be formed between solid polymer components using manufacturer's approved seam adhesive. Joints shall be inconspicuous in appearance and without voids to create a monolithic appearance.

#### 2.4.2 Edge Finishing

Rout and finish component edges to a smooth, uniform appearance and finish. Edge shapes and treatments, including any inserts, shall be as detailed on the drawings. Rout all cutouts, then sand all edges smooth. Repair or reject defective or inaccurate work.

#### 2.4.3 Counter and Vanity Top Splashes

Backsplashes and end splashes shall be fabricated from 3/4 inch thick solid surfacing material and shall be 4 inches high. Backsplashes and end splashes shall be provided for all counter tops and vanity tops. Backsplashes shall be shop fabricated and be permanently attached.

##### 2.4.3.1 Permanently Attached Backsplash

Permanently attached backsplashes shall be attached with seam adhesive and to form a radiused coved transition from countertop to backsplash.

##### 2.4.3.2 End Splashes

End splashes shall be provided loose for installation at the jobsite after horizontal surfaces to which they are to be attached have been installed.

#### 2.4.4 Solid Surfacing Counter and Vanity Tops

Solid surfacing countertops, solid polymer counter top and vanity top components shall be fabricated from 3/4 inch thick material. Edge details, dimensions, locations, and quantities shall be as indicated on the Drawings. Counter tops shall be complete with 4 inch high permanently attached with coved transition backsplash and loose end splashes at all locations. Attach 2 inch wide reinforcing strip of polymer material under each horizontal counter top seam.

##### 2.4.4.1 Counter Top With Sink

###### a. Solid Polymer Sink

Solid polymer sinks shall be a manufacturer's standard, pre-molded product specifically designed for attachment to solid polymer counter tops.

#### 2.4.4.2 Vanity Tops With Bowls

##### a. Solid Polymer Bowl

Solid polymer bowls shall be a solid polymer manufacturer's standard, pre-molded product specifically designed for attachment to solid polymer counter tops.

#### 2.4.5 Solid Polymer Sinks

Solid polymer sinks shall be a standard product of the solid polymer manufacturer, designed specifically to be installed in solid polymer countertops. Sinks shall be of the same polymer composition as the adjoining counter top. Sink design shall support a seam adhesive flush installation method. Sinks shall be a single bowl and double bowl configuration as shown on the drawings. Sink dimensions shall be as indicated on the drawings.

#### 2.4.6 Solid Polymer Vanity Bowls

Solid polymer vanity bowls shall be a standard product of the solid polymer manufacturer, designed specifically to be installed in solid polymer vanity tops. Bowls shall be of the same polymer composition as the adjoining counter top. Bowl design shall support a seam adhesive flush installation method. Bowl dimensions shall be as indicated on the drawings.

### PART 3 EXECUTION

#### 3.1 COORDINATION

In most instances, installation of solid polymer fabricated components and assemblies will require strong, correctly located structural support provided by other trades. To provide a stable, sound, secure installation, close coordination is required between the solid polymer fabricator/installer and other trades to insure that necessary structural wall support, cabinet counter top structural support, proper clearances, and other supporting components are provided for the installation of wall panels, countertops, shelving, and all other solid polymer fabrications to the degree and extent recommended by the solid polymer manufacturer. Contractor shall appropriate staging areas for solid polymer fabrications.

#### 3.2 INSTALLATION

##### 3.2.1 Components

All components and fabricated units shall be installed plumb, level, and rigid. Field joints between solid polymer components to provide a monolithic appearance shall be made using solid polymer manufacturer's approved seam adhesives, with joints inconspicuous in the finished work. Metal or vitreous china sinks and lavatory bowls shall be attached to counter tops using solid polymer manufacturer's recommended clear silicone sealant and mounting hardware. Solid polymer sinks and bowls shall be installed using a color-matched seam adhesive. Plumbing connections to sinks and lavatories shall be made in accordance with Section 15400A

## PLUMBING, GENERAL PURPOSE.

## 3.2.1.1 Loose Counter Top Splashes

Loose splashes shall be mounted in locations as noted on the drawings. Loose splashes shall be adhered to the counter top with a color matched silicone sealant when the solid polymer components are solid colors. Adhesion of particulate patterned solid polymer splashes to counter tops shall utilize a clear silicone sealant.

## 3.2.2 Silicone Sealant

A clear, silicone sealant or caulk shall be used to seal all expansion joints between solid polymer components and all joints between solid polymer components and other adjacent surfaces such as walls and plumbing fixtures. Sealant bead shall be smooth and uniform in appearance and shall be the minimum size necessary to bridge any gaps between the solid surfacing material and the adjacent surface. Bead shall be continuous and run the entire length of the joint being sealed.

## 3.2.3 Plumbing

Plumbing connections to sinks and lavatories shall be made in accordance with Section 15400A.

## 3.3 CLEAN-UP

Components shall be cleaned after installation and covered to protect against damage during completion of the remaining project items. Components damaged after installation by other trades will be repaired or replaced at the General Contractor's cost. The component supplier will provide a repair/replace cost estimate to the General Contractor who shall approve estimate before repairs are made.

-- End of Section --

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## DIVISION 07 - THERMAL &amp; MOISTURE PROTECTION

## SECTION 07240

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## 10/01

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## SECTION 07240

EXTERIOR INSULATION AND FINISH SYSTEMS  
10/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred within the text by the basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 117	(1997) Operating Salt Spray (Fog) Apparatus
ASTM C 67	(2000) Sampling and Testing Brick and Structural Clay products
ASTM C 150	(2000) Portland Cement
ASTM C 578	(1995) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 920	(1998) Elastomeric Joint Sealants
ASTM D 968	(1993) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D 2247	(1999) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 3273	(2000) Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
ASTM E 84	(2000) Surface Burning Characteristics of Building Materials
ASTM E 330	(1997) Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
ASTM E 331	(2000) Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
ASTM E 695	(1997) Measuring Relative Resistance of Wall, Floor, and Roof Construction to Impact Loading
ASTM G 23	(1996) Operating Light-Exposure Apparatus (Carbon-Arc Type) with and Without Water for Exposure of Nonmetallic Materials

## EXTERIOR INSULATION MANUFACTURERS ASSOCIATION (EIMA)

EIMA TM 101.01	(1995) Freeze/Thaw Resistance of Exterior Insulation and Finish Systems (EIFS), Class PB.
EIMA TM 101.86	(1995, Rev. Aug. 1995) Resistance of Exterior Insulation and Finish Systems, Class PB, to the Effects of Rapid Deformation (Impact)
ASTM E 2098	(1995) Alkali Resistance of Glass Fiber Reinforcing Mesh for Use in Exterior Insulation and Finish Systems

## INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO)

UBC 26-4	Evaluation of Flammability Characteristics of Exterior, Non load-Bearing Wall Panel Assemblies using Foam Plastic Insulation
UBC 26-9	Evaluation of Flammability Characteristics of Exterior Non load-Bearing Wall Assemblies Containing Combustible Components using Intermediate-Scale, Multistory Test Apparatus Title

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 268	(1996) Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source
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## 1.2 SYSTEM DESCRIPTION AND REQUIREMENTS

The exterior insulation and finish system (EIFS) shall be a job-fabricated exterior wall covering consisting of insulation board, reinforcing fabric, base coat, finish coat, adhesive and mechanical fasteners as applicable. The system components shall be compatible with each other and with the substrate as recommended or approved by, and the products of, a single manufacturer regularly engaged in furnishing Exterior Insulation and Finish Systems. Only an installer trained and approved by the EIFS manufacturer shall be used. EIFS shall be a Class PB, engineered moisture drainage system, designed for positive drainage of incidental moisture which may accumulate within or behind the system. The surface finish texture shall be similar to "Swirl Coarse" by PAREX EIFS. Color shall be in accordance with SECTION 09915.

## 1.2.1 System Requirements and Tests

The system shall meet the performance requirements as verified by the tests listed below. Where a wall system of similar type, size, and design as specified for this project has been previously tested under the condition specified herein, the resulting test reports may be submitted in lieu of job specific tests.

## 1.2.1.1 Water Penetration

Test the system for water penetration by uniform static air pressure in accordance with ASTM E 331. There shall be no penetration of water beyond the plane of the base coat/EPS board interface after 15 minutes at 6.4 psf, or 20% of positive design wind pressure, whichever is greater.

#### 1.2.1.2 Wind Load

Test the system for wind load by uniform static air pressure in accordance with ASTM E 330 (procedure A) to a minimum pressure (positive and negative) of 40 psf. There shall be no permanent deformation, delamination, or other deterioration at 1.5 times the design wind load (positive and negative).

#### 1.2.1.3 Full scale or intermediate scale fire test

Conduct wall fire test using apparatus, specimen, performance criteria, and procedure in accordance with UBC 26-4. The specimen shall include the complete system using 4 inch thick insulation board. At the option of the contractor, UBC 26-9, Intermediate-Scale Test may be substituted in lieu of the Full-Scale Multi- Story Fire test. The following requirements shall be met:

- a. No vertical spread of flame within core of panel from one story to the next.
- b. No flame spread over the exterior surface.
- c. No vertical flame spread over the interior surface from one story to the next.
- d. No significant lateral spread of flame from compartment of fire origin to adjacent spaces.

#### 1.2.2 Component Requirements and Tests

The components of the system shall meet the performance requirements as verified by the tests listed below.

##### 1.2.2.1 Surface Burning Characteristics

Conduct ASTM E 84 test on samples consisting of insulation board, base coat, reinforcing fabric, and finish coat. Cure for 28 days. The flame spread index shall be 25 or less and the smoke developed index shall be 450 or less.

##### 1.2.2.2 Radiant Heat

The system shall be tested in accordance with NFPA 268 with no ignition during the 20-minute period.

##### 1.2.2.3 Impact Resistance

- a. Class PB Systems: Hemispherical Head Test; 28 day cured specimen of PB EIFS in accordance with EIMA TM 101.86. The test specimen shall exhibit no broken reinforcing fabric per EIMA TM 101.86 at an impact of 150 in/lb.
- b. Impact Mass: Test 28 day cured specimen of PM EIFS in accordance with ASTM E 695. The test specimen shall exhibit no cracking or

denting after twelve impacts by 30 lbs lead shot mass from 6 in to 6 ft drop heights in 6 in intervals.

### 1.2.3 Sub-Component Requirements and Tests

Unless otherwise stated, the test specimen shall consist of reinforcement, base coat, and finish coat applied in accordance with manufacturer's printed recommendations to the insulation board to be used on the building.

For mildew resistance, only the finish coat is applied onto glass slides for testing. These specimen shall be suitably sized for the apparatus used and be allowed to cure for a minimum of 28 days prior to testing.

#### 1.2.3.1 Abrasion Resistance

Test in accordance with ASTM D 968, Method A. Test a minimum of two specimen. After testing, the specimens shall show only very slight smoothing, with no loss of film integrity after 132 gallons of sand.

#### 1.2.3.2 Accelerated Weathering

Test in accordance with ASTM G 23, Method 1. After 2000 hours specimens shall exhibit no visible cracking, flaking, peeling, blistering, yellowing, fading, or other such deterioration.

#### 1.2.3.3 Mildew Resistance

Test in accordance with ASTM D 3273. The specimen shall consist of the finish coat material, applied to clean 3 inch by 4 inch glass slides and shall be allowed to cure for 28 days. After 28 days of exposure, the specimen shall not show any growth.

#### 1.2.3.4 Salt Spray Resistance

Test in accordance with ASTM B 117. The specimen shall be a minimum of 4 inch by 6 inch and shall be tested for 300 hours. After exposure, the specimen shall exhibit no observable deterioration, such as chalking, fading, or rust staining.

#### 1.2.3.5 Water Resistance

Test in accordance with ASTM D 2247. The specimen shall be a minimum of 4 inch by 6 inch. After 14 days, the specimen shall exhibit no cracking, checking, crazing, erosion, blistering, peeling, or delamination.

#### 1.2.3.6 Absorption-Freeze/Thaw

Class PB systems shall be tested in accordance with EIMA TM 101.01 for 60 cycles of freezing and thawing when viewed under 5x magnification. No cracking, checking, or splitting, and negligible weight gain. Class PM systems shall be tested in accordance with ASTM C 67 for 50 cycles of freezing and thawing. After testing, the specimens shall exhibit no cracking or checking, and have negligible weight gain.

#### 1.2.3.7 Sample Boards

Unless otherwise stated, provide sample EIFS Component 12 by 24 inches, including finish color and texture, typical joints and sealant. If more than one color, finish, or pattern is used, provide one sample for each. The test specimen shall consist of reinforcement, base coat, and finish

coat applied in accordance with manufacturer's printed recommendations to the insulation board to be used on the building.

#### 1.2.3.8 Water Penetration

The system shall be tested for water penetration by uniform static air pressure in accordance with ASTM E 331. No penetration of water beyond the plane of the base coat/EPS board interface after 15 minutes at 6.24 psf, or 20% of positive design wind pressure, whichever is greater.

#### 1.2.4 Moisture Analysis

Perform a job specific vapor transmission analysis based on project specific climate and specified wall components and materials. Indicate the temperatures and relative humidities for the inside and outside of the building; a complete listing of the building components, their thickness, thermal resistance and permeance, as well as building location and use. If a mathematical model was used for the analysis, include the name of the model and the supplier/developer.

### 1.3 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

#### SD-02 Shop Drawings

Shop drawings; G-DO

Show wall layout, construction and expansion joints, decorative grooves, layout of thermal insulation board, and reinforcement mesh and strip reinforcing fabric; joint and flashing details; details at wall penetrations; types and location of fasteners; details at windows and doors; and details at base, roof, corners and other EIFS areas.

#### SD-03 Product Data

Thermal insulation; G-DO

Adhesive; G-DO

Mechanical Fasteners; G-DO

Accessories; G-DO

Base coat; G-DO

Portland cement; G-DO

Reinforcing fabric; G-DO

Finish coat; G-DO

Joint Sealant; G-DO

Primer; G-DO

Bond breaker; G-DO

Backer Rod; G-DO

Insulation Board; G-DO

Warranty; G-DO

Include joint and other details, such as end conditions, corners, windows, parapet. Include shelf life and recommended cleaning solvents in data for sealants. Include material safety data sheets (MSDS) for all components of the EIFS. The MSDS shall be available at the job site.

SD-04 Samples

Sample Boards;

Color and Texture

SD-05 Design Data

Wind load; Calculations

Moisture analysis; Calculations

SD-06 Test Reports

Abrasion resistance;

Accelerated weathering;

Impact resistance;

Mildew resistance;

Salt spray resistance;

Water vapor transmission;

Absorption-freeze-thaw;

Flame spread;

Water penetration;

Water resistance;

Flame spread;

Surface Burning Characteristics;

Radiant heat;

Substrate;

Wind load;

SD-07 Certificates

Qualifications of EIFS Manufacturer;

Qualification of EIFS Installer;

Qualification of Sealant Applicator;

Certify that EIFS installer meets requirements specified under paragraph "Qualification of Installer," and that sealant applicator is approved by the EIFS Manufacturer.

Qualifications of Third Party Inspector (Manufacturer's Field Representative);

Submit evidence that third party inspector has current certification from the Exterior Design Institute and is certified and approved by the EIFS manufacturer as an inspector for the installation of EIFS.

Inspection Check List;

Submit filled-out inspection check list as required in paragraph "Quality Control," certifying that the installation of critical items meets the requirements of this specification.

#### SD-08 Manufacturer's Instructions

Installation;

Manufacturer's standard printed instructions for the installation of the EIFS. Include requirements for condition and preparation of substrate, installation of EIFS, and requirements for sealants and sealing.

#### SD-10 Operation and Maintenance Data

EIFS;

Include detailed finish repair procedures and information regarding compatibility of sealants with base and finish coatings.

### 1.4 QUALITY ASSURANCE

#### 1.4.1 Qualifications of EIFS Manufacturer

The EIFS shall be the product of a manufacturer who has been in the practice of manufacturing and designing EIFS for a period of not less than 3 years, and has been involved in at least five projects similar to this project in size, scope, and complexity, in the same or a similar climate as this project.

#### 1.4.2 Qualification of EIFS Installer

The EIFS Installer shall be trained and approved by the EIFS manufacturer to install the system and shall have successfully installed at least five projects at or near the size and complexity of this project. The contractor shall employ qualified workers trained and experienced in installing the manufacturer's EIFS.

#### 1.4.3 Qualification of Sealant Applicator

The sealant applicator shall be experienced and competent in the installation of high performance industrial and commercial sealants and shall have successfully installed at least five projects at or near the size and complexity of this project.

#### 1.4.4 Insulation Board

Insulation Board shall be approved and labeled under third party quality program as required by applicable building code.

#### 1.4.5 Pre-Installation Conference

After approval of submittals and before commencing any work on the EIFS , including installation of any insulation, and associated work, the Contracting Officer will hold a pre-installation conference to review:

- a. Drawings, specifications, and samples;
- b. Procedure for on site inspection and acceptance of EIFS substrate and pertinent details;
- c. Contractor's plan for coordination of work of the various trades involved in providing EIF system and other components;
- d. Inspection procedures; and
- e. Safety requirements.

Pre-installation conference shall be attended by the Contractor, EIFS Installer, Sealant Applicator, the Third Party Inspector (Manufacturer's Representative), Contractor's Q.C., and all personnel directly responsible for installation of the EIF system, including sealant applicator, and personnel responsible for related work, such as flashing and sheet metal, windows and doors, and a representative of the EIFS manufacturer. Before beginning EIFS work, the contractor shall confirm in writing the resolution of conflicts among those attending the preinstallation conference.

#### 1.5 DELIVERY AND STORAGE

Deliver materials to job site in original unopened packages, marked with manufacturer's name, brand name, and description of contents. Store materials off the ground and in accordance with the manufacturer's recommendations in a clean, dry, well-ventilated area. Protect stored materials from rain, sunlight, and excessive heat. Keep coating materials which would be damaged by freezing at a temperature not less than 40 degrees F. Do not expose insulation board to flame or other ignition sources.

#### 1.6 ENVIRONMENTAL CONDITIONS

- a. Do not prepare materials or apply EIFS during inclement weather unless appropriate protection is provided. Protect installed materials from inclement weather until they are dry.
- b. Apply sealants and wet materials only at ambient temperatures of 40 degrees F or above and rising, unless supplemental heat is provided. The system shall be protected from inclement weather and to maintain this temperature for a minimum of 24 hours after

installation.

- c. Do not leave insulation board exposed to sunlight after installation.

#### 1.7 WARRANTY

Furnish manufacturer's standard warranty for the EIFS. Warranty shall run directly to Government and cover a period of not less than 5 years from date Government accepted the work.

### PART 2 PRODUCTS

#### 2.1 COMPATIBILITY

Provide all materials compatible with each other and with the substrate, and as recommended by EIFS manufacturer.

#### 2.2 ADHESIVE

Manufacturer's standard product, including primer as required, and shall be compatible with substrate and insulation board to which the system is applied.

#### 2.3 MECHANICAL FASTENERS

Corrosion resistant and as approved by EIFS manufacturer. Select fastener type and pattern based on applicable wind loads and substrate into which fastener will be attached, to provide the necessary pull-out, tensile, and shear strengths.

#### 2.4 THERMAL INSULATION

##### 2.4.1 Manufacturer's Recommendations

Provide only thermal insulation recommended by the EIFS manufacturer for the type of application intended.

##### 2.4.2 Insulation Board

Insulation board shall be standard product of manufacturer and shall be compatible with other systems components. Boards shall be factory marked individually with the manufacturer's name or trade mark, the material specification number, the R-value at 75 degree F, and thickness. No layer of insulation shall be less than 3/4 in thick. Insulation Board shall be certified as aged, in block form, prior to cutting and shipping, a minimum of 6 weeks by air drying, or equivalent.

- a. Thermal resistance: As indicated
- b. Insulating material: ASTM C 578 Type I or IV, as recommended by the EIFS manufacturer and treated to be compatible with other EIFS components. Age insulation by air drying a minimum of 6 weeks prior to cutting and shipping.

#### 2.5 BASE COAT

Manufacturer's standard product and compatible with other systems components.

## 2.6 PORTLAND CEMENT

Conform to ASTM C 150, Type I or II as required, fresh and free of lumps, and approved by the systems manufacturer.

## 2.7 REINFORCING FABRIC

Reinforcing fabric mesh shall be alkali-resistant, balanced, open weave, glass fiber fabric made from twisted multi-end strands specifically treated for compatibility with the other system materials, and comply with ASTM E 2098 and as recommended by EIFS manufacturer. Two layers of reinforcing mesh shall be used at all areas of EIFS. The first layer shall be a heavy duty 20 ounce mesh, and the second layer shall be manufacturer's recommended weight mesh to achieve the EIFS testing requirements.

## 2.8 FINISH COAT

Manufacturer's standard product conforming to the requirements in the paragraph on Sub-Component Requirements and Tests. For color consistency, use materials from the same batch or lot number.

## 2.9 PRIMER

Non-staining, quick-drying type recommended by sealant manufacturer and EIFS manufacturer.

## 2.10 ACCESSORIES

Conform to recommendations of EIFS manufacturer, including trim, edging, anchors, expansion joints. All metal items and fasteners to be corrosion resistant.

## 2.11 JOINT SEALANT

Non-staining, quick-drying type meeting ASTM C 920, Class 25, compatible with the finish system type and grade, and recommended by both the sealant manufacturer and EIFS manufacturer.

## 2.12 BOND BREAKER

As required by EIFS manufacturer and recommended by sealant manufacturer and EIFS manufacturer.

## 2.13 BACKER ROD

Closed cell polyethylene free from oil or other staining elements and as recommended by sealant manufacturer and EIFS manufacturer. Do not use absorptive materials as backer rod. The backer rod should be sized 25 percent larger than the width of the joint.

## 2.14 MOISTURE BARRIER

Moisture barrier shall be the manufacturer's standard sheet or liquid applied product and shall be compatible with other system components.

## PART 3 EXECUTION

### 3.1 EXAMINATION

Examine substrate and existing conditions to determine that the EIFS can be installed as required by the EIFS manufacturer and that all work related to the EIFS is properly coordinated. Surface shall be sound and free of oil, loose materials or protrusions which will interfere with the system installation. If deficiencies are found, notify the Contracting Officer and do not proceed with installation until the deficiencies are corrected. The substrate shall be plane, with no deviation greater than 1/4 inch when tested with a 10 foot straightedge. Determine flatness, plumbness, and any other conditions for conformance to manufacturer's instructions.

### 3.2 SURFACE PREPARATION

Prepare existing surfaces for application of the EIFS to meet flatness tolerances and surface preparation according to manufacturer's installation instructions but provide a flatness of not more than 1/4 inch in 10 feet. Provide clean surfaces free of oil and loose material without protrusions adversely affecting the installation of the insulation board. For adhesively attached EIFS, existing deteriorated paint must be removed. Due to substrate conditions or as recommended by the system manufacturer, a primer may be required. Apply the primer to existing surfaces as recommended by the manufacturer. Use masking tape to protect areas adjacent to the EIFS to prevent base or finish coat to be applied to areas not intended to be covered with the EIFS. The contractor shall not proceed with the installation until all noted deficiencies of the substrate are corrected.

### 3.3 INSTALLATION

Install EIFS as indicated, comply with manufacturer's instructions except as otherwise specified, and in accordance with the shop drawings. EIFS shall be installed only by an applicator trained and approved by the EIFS manufacturer. Specifically, include all manufacturer recommended provisions regarding flashing and treatment of wall penetrations.

#### 3.3.1 Insulation Board

Unless otherwise specified by the system manufacturer, place the long edge horizontally from level base line. Stagger vertical joints and interlock at corners. Butt joints tightly. Provide flush surfaces at joints. Offset insulation board joints from joints in sheathing by at least (8 inches). Use L-shaped insulation board pieces at corners of openings. Joints of insulation shall be butted tightly. Surfaces of adjacent insulation boards shall be flush at joints. Gaps greater than (1/16 inch) between the insulation boards shall be filled with slivers of insulation. Uneven board surfaces with irregularities projecting more than (1/16 inch) shall be rasped in accordance with the manufacturer's instructions to produce an even surface. Attach insulation board as recommended by manufacturer. The adhered insulation board shall be allowed to remain undisturbed for 24 hours prior to proceeding with the installation of the base coat/reinforcing mesh, or longer if necessary for the adhesive to dry. However, do not leave insulation board exposed longer than recommended by insulation manufacturer.

##### 3.3.1.1 Mechanically Fastened Insulation Boards

Fasten with manufacturer's standard corrosion resistant anchors, spaced as recommended by manufacturer, but not more than 2 feet horizontally and

vertically.

### 3.3.1.2 Adhesively Fastened Insulation Boards

Apply insulation board using adhesive spread with a notched trowel to the back of the insulation boards in accordance with the manufacturer's instructions.

### 3.3.2 Base Coat and Reinforcing Fabric Mesh,

#### 3.3.2.1 Class PB Systems

Mix base coat in accordance with the manufacturer's instructions and apply to insulated wall surfaces to the thickness specified by the system manufacturer and provide any other reinforcement recommended by EIFS manufacturer. Trowel the reinforcing fabric mesh into the wet base coat material. Fully embed the mesh in the base coat. When properly worked-in, the pattern of the reinforcing fabric mesh shall not be visible. Provide diagonal reinforcement at opening corners. Back-wrap all terminations of the EIFS. Overlap the reinforcing fabric mesh a minimum of 2 inches on previously installed mesh, or butted, in accordance with the manufacturer's instructions. Allow the adhered insulation board to dry for 24 hours, or longer if necessary, prior to proceeding with the installation of the base coat/reinforcing fabric mesh. Install reinforcing fabric in accordance with manufacturer's instructions.

### 3.3.3 Finish Coat

Apply and level finish coat in one operation. Obtain final texture by trowels, floats, or by spray application as necessary to achieve the required finish matching approved sample. Apply the finish coat to the dry base coat maintaining a wet edge at all times to obtain a uniform appearance. The thickness of the finish coat shall be in accordance with the system manufacturer's current published instructions. Apply finish coat so that it does not cover surfaces to which joint sealants are to be applied. The base coat/reinforcing mesh must be allowed to dry a minimum of 24 hours prior to the application of the finish coat. Surface irregularities in the base coat, such as trowel marks, board lines, reinforcing mesh laps, etc., shall be corrected prior to application of the finish coat.

### 3.4 JOINT SEALING

Seal EIFS at openings as recommended by the system manufacturer. Apply sealant only to the base coat. Do not apply sealant to the finish coat.

#### 3.4.1 Surface Preparation, Backer Rod, and Primer

Immediately prior to application, remove loose matter from joint. Ensure that joint is dry and free of paint, finish coat, or other foreign matter. Install backer rod. Apply primer as required by sealant and EIFS manufacturer. Check that joint width is as shown on drawings but in no case shall it be less than 0.5 inch for perimeter seals and 0.75 inch for expansion joints. The width shall not be less than 4 times the anticipated movement. Check sealant manufacturer's recommendations regarding proper width to depth ratio.

#### 3.4.2 Sealant

Apply sealant in accordance with sealant manufacturer's instructions with gun having nozzle that fits joint width. Do not use sealant that has exceeded shelf life or can not be discharged in a continuous flow. Completely fill the joint solidly with sealant without air pockets so that full contact is made with both sides of the joint. Tool sealant with a round instrument that provides a concave profile and a uniformly smooth and wrinkle free sealant surface. Do not wet tool the joint with soap, water, or any other liquid tooling aid. Do not apply sealant until all EIFS coatings are fully dry. During inclement weather, protect the joints until sealant application. Use particular caution in sealing joints between window and door frames and the EIFS wall and at all other wall penetrations. Clean all surfaces to remove excess sealant.

3.5 FIELD QUALITY CONTROL

Throughout the installation, the contractor shall establish and maintain an inspection procedure to assure compliance of the installed EIFS with contract requirements. Work not in compliance shall be removed and replaced or corrected in an approved manner. The inspection procedures, from acceptance of deliveries through installation of sealants and final acceptance shall be performed by qualified inspector trained by the manufacturer. No work on the EIFS shall be performed unless the inspector is present at the job site.

3.5.1 Third Party Inspection (Manufacturer's Field Representative)

Provide full time third party inspection during the entire process of installing the EIFS, from examination through cleanup. The third party inspector shall be certified by the Exterior Design Institute (EDI) or by an equivalent independent party and shall be trained in the proper installation of EIFS.

3.5.2 Inspection Check List

During the installation and at the completion of installation, perform inspections covering at the minimum all applicable items enumerated on the attached check list. The inspector shall initial and date all applicable items, sign the check list, and submit it to the Contracting Officer at the completion of the EIFS erection.

CHECK LIST

<u>Item</u>	<u>Description</u>	<u>Appr'd/Date</u>
a.	Materials are handled and stored correctly.	_____
b.	Environmental conditions are within specified limits, including temperature not below 4 degrees C (40 degrees F), and the work is protected from the elements as required.	_____
c.	Preparation and installation is performed by qualified personnel using the correct tools.	_____
d.	Adjacent areas to which EIFS is not to be applied (such as on window and door frames) are protected with masking tape, plastic films, drop cloths, etc. to prevent accidental application of EIFS materials.	_____

CHECK LIST

<u>Item</u>	<u>Description</u>	<u>Appr'd/Date</u>
e.	Control, expansion and aesthetic joints are installed as indicated or recommended. Accessories are properly installed.	=====
f.	Substrate is in-plane, properly attached, clean, dry, and free of contaminants. Concrete substrate is free of efflorescence.	=====
g.	Materials are mixed thoroughly and in proper proportions.	=====
h.	Adhesive is applied in sufficient quantity with proper-size notched trowel.	=====
i.	Mechanical attachments have proper spacing, layout and fastener depth.	=====
j.	Insulation boards are tightly abutted, in running bond pattern, with joints staggered with the sheathing, board corners interlocked, L-shaped boards around openings, edges free of adhesive, and provision for joints. Gaps are filled and surfaces rasped.	=====
k.	Insulation adhesive must be allowed to dry (a minimum of 24-hours) prior to the application of the finish coat.	=====
l.	Reinforcing fabric mesh is properly back-wrapped at terminations.	=====
m.	Reinforcing fabric mesh is fully embedded and properly placed. Corners are reinforced. Openings are diagonally reinforced. Mesh overlaps minimum 2-1/2 inches.	=====
n.	Base coat thickness is within specified limits.	=====
o.	The base coat/reinforcing fabric mesh must be allowed to dry (a minimum of 24-hours) prior to the application of the finish coat.	=====
p.	Finish coat is applied with sufficient number of personnel and stopped at suitable points. Floats and methods of texturing are uniform.	=====
q.	All Flashings are properly installed.	=====
r.	All joints are properly sealed in their entire length at time and under environmental conditions as specified by the manufacturer.	=====
s.	All scaffolding, equipment, materials, debris and temporary protection are removed from site upon completion.	=====

Name of Inspector:\_\_\_\_\_ Signed:\_\_\_\_\_ Date:\_\_\_\_\_

3.6 CLEANUP

Upon completion, remove all scaffolding, equipment, materials and debris from site. Remove all temporary protection installed to facilitate installation of EIFS.

-- End of Section --

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11/01

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## SECTION 07416A

STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM  
11/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## ALUMINUM ASSOCIATION (AA)

AA Design Manual (2000) Aluminum Design Manual:  
Specification & Guidelines for Aluminum  
Structures

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC ASD Spec (1989) Specification for Structural Steel  
Buildings - Allowable Stress Design,  
Plastic Design

## AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI Cold-Formed Mnl (1996) Cold-Formed Steel Design Manual

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 463/A 463M (2000) Steel Sheet, Aluminum-Coated, by  
the Hot-Dip Process

ASTM A 653/A 653M (2000) Steel Sheet, Zinc-Coated  
(Galvanized) or Zinc-Iron Alloy-Coated  
(Galvannealed) by the Hot-Dip Process

ASTM A 792/A 792M (1999) Steel Sheet, 55% Aluminum-Zinc  
Alloy-Coated by the Hot-Dip Process

ASTM B 209 (2000) Aluminum and Aluminum-Alloy Sheet  
and Plate

ASTM B 209M (2000) Aluminum and Aluminum-Alloy Sheet  
and Plate (Metric)

ASTM C 1177/C 1177M (1999) Glass Mat Gypsum Substrate for Use  
as Sheathing

ASTM C 1289 (1998) Faced Rigid Cellular  
Polyisocyanurate Thermal Insulation Board

ASTM C 518 (1998) Steady-State Heat Flux Measurements  
and Thermal Transmission Properties by  
Means of the Heat Flow Meter Apparatus

ASTM C 991	(1998) Flexible Glass Fiber Insulation for Pre-Engineered Metal Buildings
ASTM D 1308	(1987; R 1998) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D 1654	(1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 2244	(1995) Calculation of Color Differences from Instrumentally Measured Color Coordinates
ASTM D 2247	(1999) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 2794	(1993; R 1999e1) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D 3359	(1997) Measuring Adhesion by Tape Test
ASTM D 4214	(1998) Evaluating Degree of Chalking of Exterior Paint Films
ASTM D 4397	(1996) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM D 522	(1993a) Mandrel Bend Test of Attached Organic Coatings
ASTM D 523	(1989; R 1999) Specular Gloss
ASTM D 5894	(1996) Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)
ASTM D 610	(1995) Evaluating Degree of Rusting on Painted Steel Surfaces
ASTM D 714	(1987; R 1994e1) Evaluating Degree of Blistering of Paints
ASTM D 968	(1993) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM E 1592	(1998) Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
ASTM E 84	(2000a) Surface Burning Characteristics of Building Materials
ASTM E 96	(2000) Water Vapor Transmission of

## Materials

ASTM G 154 (2000a) Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

## AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7 (1998) Minimum Design Loads for Buildings and Other Structures

## 1.2 GENERAL REQUIREMENTS

The Contractor shall furnish a commercially available roofing system which satisfies all requirements contained herein and has been verified by load testing and independent design analyses to meet the specified design requirements.

## 1.2.1 Structural Standing Seam Metal Roof (SSSMR) System

The SSSMR system covered under this specification shall include the entire roofing system; the standing seam metal roof panels, fasteners, connectors, roof securement components, and assemblies tested and approved in accordance with ASTM E 1592. In addition, the system shall consist of panel finishes, slip sheet, insulation, vapor retarder, all accessories, components, and trim and all connections with roof panels. This includes roof penetration items such as gutters and downspouts; eaves, ridge, hip, valley, rake, gable, wall, or other roof system flashings installed and any other components specified within this contract to provide a weathertight roof system.

## 1.2.2 Manufacturer

The SSSMR system shall be the product of a manufacturer who has been in the practice of manufacturing and designing SSSMR systems for a period of not less than 3 years and has been involved in at least five projects similar in size and complexity to this project.

## 1.2.3 Installer

The installer shall be certified by the SSSMR system manufacturer to have experience in installing at least three projects that are of comparable size, scope and complexity as this project for the particular roof system furnished. The installer may be either employed by the manufacturer or be an independent installer.

## 1.3 DESIGN REQUIREMENTS

The design of the SSSMR system shall be provided by the Contractor as a complete system. Members and connections not indicated on the drawings shall be designed by the Contractor. Roof panels, components, transitions, accessories, and assemblies shall be supplied by the same roofing system manufacturer.

## 1.3.1 Design Criteria

Design criteria shall be in accordance with ASCE 7, unless otherwise specified herein.

### 1.3.2 Dead Loads

The dead load shall be the weight of the SSSMR system. Collateral loads such as sprinklers, mechanical and electrical systems, and ceilings shall not be attached to the panels.

### 1.3.3 Live Loads

#### 1.3.3.1 Concentrated Loads

The panels and anchor clips shall be capable of supporting a 300 pound concentrated load. The concentrated load shall be applied at the panel midspan and will be resisted by a single standing seam metal roof panel assumed to be acting as a beam. The undeformed shape of the panel shall be used to determine the section properties.

#### 1.3.3.2 Minimum Uniform Load

The panels and concealed anchor clips shall be capable of supporting a minimum uniform live load of 20 psf. See also paragraph, "Roof Snow Loads."

### 1.3.4 Roof Snow Loads

The design roof snow loads shall be as shown on the contract drawings.

### 1.3.5 Wind Loads

The design wind uplift pressure for the roof system shall be as shown on the contract drawings. The design uplift force for each connection assembly shall be that pressure given for the area under consideration, multiplied by the tributary load area of the connection assembly. The safety factor listed below shall be applied to the design force and compared against the ultimate capacity. Prying shall be considered when figuring fastener design loads.

- a. Single fastener in each connection.....3.0
- b. Two or more fasteners in each connection...2.25

### 1.3.6 Thermal Loads

Roof panels shall be free to move in response to the expansion and contraction forces resulting from a total temperature range of 220 degrees F during the life of the structure.

### 1.3.7 Framing Members Supporting the SSSMR System

Any additions/revisions to framing members supporting the SSSMR system to accommodate the manufacturer/fabricator's design shall be the Contractor's responsibility and shall be submitted for review and approval. New or revised framing members and their connections shall be designed in accordance with AISC ASD Spec or AISI Cold-Formed Mnl. Maximum deflection under applied live load, snow, or wind load shall not exceed 1/180 of the span length.

### 1.3.8 Roof Panels Design

Steel panels shall be designed in accordance with AISI Cold-Formed Mnl. The structural section properties used in the design of the panels shall be

determined using the unloaded shape of the roof panels. The calculated panel deflection from concentrated loads shall not exceed 1/180 of the span length. The calculated panel deflection under applied live load, snow, or wind load shall not exceed 1/180 times the span length. Deflections shall be based on panels being continuous across three or more supports. Deflection shall be calculated and measured along the major ribs of the panels.

#### 1.3.9 Accessories and Their Fasteners

Accessories and their fasteners shall be capable of resisting the specified design wind uplift forces and shall allow for thermal movement of the roof panel system. Exposed fasteners shall not restrict free movement of the roof panel system resulting from thermal forces. There shall be a minimum of two fasteners per clip. Single fasteners with a minimum diameter of 3/8 inch will be allowed when the supporting structural members are prepunched or predrilled.

#### 1.4 PERFORMANCE REQUIREMENTS

The SSSMR shall be tested for wind uplift resistance in accordance with ASTM E 1592; SSSMR systems previously tested and approved by the Corps of Engineers' STANDARD TEST METHOD FOR STRUCTURAL PERFORMANCE OF SSMRS BY UNIFORM STATIC AIR PRESSURE DIFFERENCE may be acceptable. Two tests shall be performed. Test 1 shall simulate the edge condition with one end having crosswise restraint and other end free of crosswise restraint. The maximum span length for the edge condition shall be 30 inches. Test 2 shall simulate the interior condition with both ends free of crosswise restraint.

The maximum span length for the interior condition shall be 5.0 feet. External reinforcement, such as clamps on the ribs, shall not be installed to improve uplift resistance. Bolts through seams shall not be installed.

#### 1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

##### SD-02 Shop Drawings

Structural Standing Seam Metal Roof System; G-DO.

Metal roofing drawings and specifications and erection drawings; shop coating and finishing specifications; and other data as necessary to clearly describe design, materials, sizes, layouts, standing seam configuration, construction details, provisions for thermal movement, line of panel fixity, fastener sizes and spacings, sealants and erection procedures. Drawings shall reflect the intent of the architectural detailing using the manufacturer's proprietary products and fabricated items as required. The SSSMR system shop drawings shall be provided by the metal roofing manufacturer.

##### SD-03 Product Data

Design Analysis; G-DO.

Design analysis signed by a Registered Professional Engineer employed by the SSSMR manufacturer. The design analysis shall include a list of the design loads, and complete calculations for the support system (when provided by the Contractor), roofing system and its components; valley designs, gutter/downspout calculations, screw pullout test results, and shall indicate how expected thermal movements are accommodated.

#### Qualifications

Qualifications of the manufacturer and installer.

#### SD-04 Samples

##### Accessories; G-DO.

One sample of each type of flashing, trim, closure, thermal spacer block, cap and similar items. Size shall be sufficient to show construction and configuration.

##### Roof Panels; G-DO.

One piece of each type to be used, 9 inches long, full width.

##### Factory Color Finish; G-DO.

Three 3 by 5 inches samples of each type and color.

##### Fasteners; G-DO.

Two samples of each type to be used, with statement regarding intended use. If so requested, random samples of bolts, nuts, and washers as delivered to the job site shall be taken in the presence of the Contracting Officer and provided to the Contracting Officer for testing to establish compliance with specified requirements.

##### Insulation; G-DO.

One piece, 12 by 12 inches, of each type and thickness to be used, with a label indicating the rated permeance (if faced) and R-values. The flame spread, and smoke developed rating shall be shown on the label or provided in a letter of certification.

##### Gaskets and Insulating Compounds; G-DO.

Two samples of each type to be used and descriptive data.

##### Sealant; G-DO.

One sample, approximately 1 pound, and descriptive data.

##### Concealed Anchor Clips; G-DO.

Two samples of each type used.

##### Subpurlins; G-DO.

One piece, 9 inches long.

EPDM Rubber Boots; G-DO.

One piece of each type.

Snow Guards; G-DO.

One piece, minimum 9 inches long with clip holder.

#### SD-06 Test Reports

Test Report for Uplift Resistance of the SSSMR; G-DO.

The report shall include the following information:

- a. Details of the SSSMR system showing the roof panel cross-section with dimensions and thickness.
- b. Details of the anchor clip, dimensions, and thickness.
- c. Type of fasteners, size, and the number required for each connection.
- d. Purlins/subpurlins size and spacing used in the test.
- e. Description of the seaming operation including equipment used.
- f. Maximum allowable uplift pressures. These pressures are determined from the ultimate load divided by a factor of safety equal to 1.65.
- g. Any additional information required to identify the SSSMR system tested.
- h. Signature and seal of an independent registered engineer who witnessed the test.

#### SD-07 Certificates

Structural Standing Seam Metal Roof System;

- a. Certification that the actual thickness of uncoated sheets used in SSSMRS components including roofing panels, subpurlins, and concealed anchor clips complies with specified requirements.
- b. Certification that materials used in the installation are mill certified.
- c. Previous certification of SSSMR system tested under the Corps of Engineers' Standard Test Method in lieu of ASTM E 1592 testing.
- d. Certification that the sheets to be furnished are produced under a continuing quality control program and that a representative sample consisting of not less than three pieces has been tested and has met the quality standards specified for factory color finish.

e. Certification of installer. Installer certification shall be furnished.

f. Warranty certificate. At the completion of the project the Contractor shall furnish signed copies of the 5-year Warranty for Structural Standing Seam Metal Roof (SSSMR) System, a sample copy of which is attached to this section, and the 20-year Manufacturer's Material Warranties, and the manufacturer's 20-year system weathertightness warranty.

Insulation; G-DO.

Certificate attesting that the polyisocyanurate insulation furnished for the project contains recovered material, and showing an estimated percent of such recovered material.

#### 1.6 DELIVERY AND STORAGE

Materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Materials shall be covered with weathertight coverings and kept dry. Storage conditions shall provide good air circulation and protection from surface staining.

#### 1.7 WARRANTIES

The SSSMR system shall be warranted as outlined below. Any emergency temporary repairs conducted by the owner shall not negate the warranties.

##### 1.7.1 Contractor's Weathertightness Warranty

The SSSMR system shall be warranted by the Contractor on a no penal sum basis for a period of five years against material and workmanship deficiencies; system deterioration caused by exposure to the elements and/or inadequate resistance to specified service design loads, water leaks, and wind uplift damage. The SSSMR system covered under this warranty shall include the entire roofing system including, but not limited to, the standing seam metal roof panels, fasteners, connectors, roof securement components, and assemblies tested and approved in accordance with ASTM E 1592. In addition, the system shall consist of panel finishes, slip sheet, insulation, vapor retarder, all accessories, components, and trim and all connections with roof panels. This includes roof penetration items such as exterior gutters and downspouts; eaves, ridge, hip, valley, rake, gable, wall, or other roof system flashings installed and any other components specified within this contract to provide a weathertight roof system; and items specified in other sections of these specifications that are part of the SSSMR system. See SECTION: 13120 STANDARD METAL BUILDING SYSTEMS for further description of metal trim and roofing related components. All roofing related items specified in SECTION 13120 shall be covered under the roofing warranty in this section. All material and workmanship deficiencies, system deterioration caused by exposure to the elements and/or inadequate resistance to specified design loads, water leaks and wind uplift damage shall be repaired as approved by the Contracting Officer. See the attached Contractor's required warranty for issue resolution of warrantable defects. This warranty shall warrant and cover the entire cost of repair or replacement, including all material, labor, and related markups. The Contractor shall supplement this warranty with written warranties from the installer and system manufacturer, which shall be submitted along with Contractor's warranty; however, the

Contractor shall be ultimately responsible for this warranty. The Contractor's written warranty shall be as outlined in attached WARRANTY FOR STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM, and shall start upon final acceptance of the facility. It is required that the Contractor provide a separate bond in an amount equal to the installed total roofing system cost in favor of the owner (Government) covering the Contractor's warranty responsibilities effective throughout the five year Contractor's warranty period for the entire SSSMR system as outlined above.

#### 1.7.2 Manufacturer's Material Warranties.

The Contractor shall furnish, in writing, the following manufacturer's material warranties which cover all SSSMR system components such as roof panels, anchor clips and fasteners, flashing, accessories, and trim, fabricated from coil material:

a. A manufacturer's 20 year material warranty warranting that the zinc-coated steel, aluminum-zinc alloy coated steel or aluminum-coated steel as specified herein will not rupture, structurally fail, fracture, deteriorate, or become perforated under normal design atmospheric conditions and service design loads. Liability under this warranty shall be limited exclusively to the cost of either repairing or replacing nonconforming, ruptured, perforated, or structurally failed coil material.

b. A manufacturer's 20 year exterior material finish warranty on the factory colored finish warranting that the finish, under normal atmospheric conditions at the site, will not crack, peel, or delaminate; chalk in excess of a numerical rating of eight, as determined by ASTM D 4214 test procedures; or change color in excess of five CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244. Liability under this warranty is exclusively limited to refinishing with an air-drying version of the specified finish or replacing the defective coated material.

c. A roofing system manufacturer's 20 year, non-prorated, system weathertightness warranty.

#### 1.8 COORDINATION MEETING

A coordination meeting shall be held 30 days prior to the first submittal, for mutual understanding of the Structural Standing Seam Metal Roof (SSSMR) System contract requirements. This meeting shall take place at the building site and shall include representatives from the Contractor, the roof system manufacturer, the roofing supplier, the erector, the SSSMR design engineer of record, and the Contracting Officer. All items required by paragraph SUBMITTALS shall be discussed, including applicable standard manufacturer shop drawings, and the approval process. The Contractor shall coordinate time and arrangements for the meeting.

### PART 2 PRODUCTS

#### 2.1 ROOF PANELS

Panels shall be steel and shall have a factory color finish. Length of sheets shall be sufficient to cover the entire length of any unbroken roof slope for slope lengths that do not exceed 30 feet. When length of run exceeds 30 feet and panel laps are provided, each sheet in the run shall extend over three or more supports. Sheets longer than 100 feet may be furnished if approved by the Contracting Officer. Width of sheets shall provide not more than 24 inches of coverage in place. SSSMR system with

roofing panels greater than 12 inches in width shall have standing seams rolled during installation by an electrically driven seaming machine. Height of standing seams shall be not less than 2 1/2 inches.

#### 2.1.1 Steel Panels

Steel panels shall be zinc-coated steel conforming to ASTM A 653/A 653M; aluminum-zinc alloy coated steel conforming to ASTM A 792/A 792M, AZ 50 coating; or aluminum-coated steel conforming to ASTM A 463/A 463M, Type 2, coating designation T2 65. Zinc, zinc-aluminum alloy or aluminum coated panels shall be 0.023 inch thick minimum. Panels shall be within 95 percent of reported tested thickness as noted in wind uplift resistance testing required in paragraph PERFORMANCE REQUIREMENTS. Prior to shipment, mill finish panels shall be treated with a passivating chemical to inhibit the formation of oxide corrosion products. Panels that have become wet during shipment and have started to oxidize shall be rejected.

#### 2.2 CONCEALED ANCHOR CLIPS

Concealed anchor clips shall be the same as the tested roofing system. Clip bases shall have factory punched or drilled holes for attachment. Clips shall be made from multiple pieces with the allowance for the total thermal movement required to take place within the clip. Single piece clips may be acceptable when the manufacturer can substantiate that the system can accommodate the thermal cyclic movement under sustained live or snow loads.

#### 2.3 ACCESSORIES

Flashing, trim, metal closure strips, caps and similar metal accessories shall be the manufacturer's standard products. Exposed metal accessories shall be finished to match the panels furnished. Die cast metal closures shall be installed with double bead tape sealant and fasteners that stitch the panel to a 16 gage preformed backer plate to ensure a positive compression of the tape sealant. The use of a continuous angle butted to the panel ends to form a closure will not be allowed.

#### 2.4 FASTENERS

Fasteners for steel roof panels shall be zinc-coated steel, corrosion resisting steel, or nylon capped steel, type and size specified below or as otherwise approved for the applicable requirements. Fasteners for structural connections shall provide both tensile and shear ultimate strengths of not less than 750 pounds per fastener. Fasteners for accessories shall be the manufacturer's standard. Exposed roof fasteners shall be sealed or have sealed washers on the exterior side of the roof to waterproof the fastener penetration. Washer material shall be compatible with the roofing; have a minimum diameter of 3/8 inch for structural connections; and gasketed portion of fasteners or washers shall be neoprene or other equally durable elastomeric material approximately 1/8 inch thick.

Exposed fasteners for factory color finished panels shall be factory finished to match the color of the panels.

##### 2.4.1 Screws

Screws for attaching anchor devices shall be not less than No. 14. Actual screw pull out test results shall be performed for the actual material gage and yield strength of the structural purlins or subpurlins to which the clip is to be anchored/attached. Other screws shall be as recommended by

the manufacturer to meet the strength design requirements of the panels.

#### 2.4.2 Bolts

Bolts shall be not less than 1/4 inch diameter, shouldered or plain shank as required, with locking washers and nuts.

#### 2.4.3 Structural Blind Fasteners

Blind screw-type expandable fasteners shall be not less than 1/4 inch diameter. Blind (pop) rivets shall be not less than 9/32 inch minimum diameter.

#### 2.5 SUBPURLINS

Cold formed supporting structural members/subpurlins shall have a minimum thickness of 0.059 inches and a minimum tensile yield strength of 50000 psi.

Hot rolled structural members shall have a minimum thickness of 0.25 inches and a minimum tensile yield strength of 36000 psi. Subpurlins shall be shop painted.

#### 2.6 FACTORY COLOR FINISH

Panels shall have a factory applied polyvinylidene fluoride finish on the exposed side. The exterior finish shall consist of a baked-on topcoat with an appropriate prime coat. Color shall match the color indicated in Section 09915 COLOR SCHEDULE. The exterior coating shall be a nominal 2 mil thickness consisting of a topcoat of not less than 0.7 mil dry film thickness and the paint manufacturer's recommended primer of not less than 1.0 mil thickness. The interior color finish shall consist of a backer coat with a dry film thickness of 0.5 mil. The exterior color finish shall meet the test requirements specified below.

##### 2.6.1 Salt Spray Test

A sample of the sheets shall withstand a cyclic corrosion test for a minimum of 2016 hours in accordance with ASTM D 5894, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating of not less than 10, no blistering, as determined by ASTM D 714; 10, no rusting, as determined by ASTM D 610; and a rating of 6, over 21/16 to 1/8 inch failure at scribe, as determined by ASTM D 1654.

##### 2.6.2 Formability Test

When subjected to testing in accordance with ASTM D 522 Method B, 1/8 inch diameter mandrel, the coating film shall show no evidence of cracking to the naked eye.

##### 2.6.3 Accelerated Weathering, Chalking Resistance and Color Change

A sample of the sheets shall be tested in accordance with ASTM G 154, test condition UVA-340 lamp, 8h UV at 60 degrees C followed by 4h CON at 45 degrees C with a minimum of 2 hours between intervals.. The coating shall withstand the weathering test without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating with an adhesion rating less than 4B when tested in accordance with ASTM D 3359, Test Method B, shall be considered as an area indicating loss of adhesion. Following the accelerated weathering test,

the coating shall have a chalk rating not less than No. 8 in accordance with ASTM D 4214 test procedures, and the color change shall not exceed 5 CIE or Hunter Lab color difference ( $\Delta E$ ) units in accordance with ASTM D 2244.

#### 2.6.4 Humidity Test

When subjected to a humidity cabinet test in accordance with ASTM D 2247 for 1000 hours, a scored panel shall show no signs of blistering, cracking, creepage or corrosion.

#### 2.6.5 Impact Resistance

Factory-painted sheet shall withstand direct and reverse impact in accordance with ASTM D 2794 0.500 inch diameter hemispherical head indenter, equal to 1.5 times the metal thickness in mils, expressed in inch-pounds, with no cracking.

#### 2.6.6 Abrasion Resistance Test

When subjected to the falling sand test in accordance with ASTM D 968, Method A, the coating system shall withstand a minimum of 80 liters of sand before the appearance of the base metal. The term "appearance of base metal" refers to the metallic coating on steel.

#### 2.6.7 Specular Gloss

Finished roof surfaces shall have a specular gloss value of 30 plus or minus 5 at 60 degrees when measured in accordance with ASTM D 523.

#### 2.6.8 Pollution Resistance

Coating shall show no visual effects when covered spot tested in a 10 percent hydrochloric acid solution for 24 hours in accordance with ASTM D 1308.

### 2.7 INSULATION

Thermal resistance of insulation shall be not less than the R-values shown on the contract drawings. R-values shall be determined in accordance with Long Term Thermal Resistance (LTTR) test methods adopted by Polyisocyanurate Insulation Manufacturers Association (PIMA), CAN/ULC-S770.

Insulation shall be a standard product with the insulation manufacturer, factory marked or identified with insulation manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages. The stated R-value of the insulation shall be certified by an independent Registered Professional Engineer if tests are conducted in the insulation manufacturer's laboratory. Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS.

#### 2.7.1 Polyisocyanurate Rigid Board Insulation for Use Above a Roof Deck

Polyisocyanurate insulation shall conform to ASTM C 1289, Type II, (having a minimum recovered material content of 9 percent by weight of core material in the polyisocyanurate portion). For impermeable faced polyisocyanurate (Ex: aluminum foil), the maximum design R-value of insulation used shall be as follows:

1.5 inches= R 9.0

2.0 inches= R 12.1  
2.5 inches= R 15.3  
3.0 inches= R 18.5  
4.0 inches= R 25.0  
Facings shall be non-asphaltic, glass fiber reinforced.

## 2.8 INSULATION RETAINERS

Insulation retainers shall be type, size, and design necessary to adequately hold the insulation and to provide a neat appearance. Metallic retaining members shall be nonferrous or have a nonferrous coating. Nonmetallic retaining members, including adhesives used in conjunction with mechanical retainers or at insulation seams, shall have a fire resistance classification not less than that permitted for the insulation.

## 2.9 SEALANT

Sealants shall be elastomeric type containing no oil or asphalt. Exposed sealant shall be colored to match the applicable building color and shall cure to a rubberlike consistency. Sealant placed in the roof panel standing seam ribs shall be provided in accordance with the manufacturer's recommendations.

## 2.10 GASKETS AND INSULATING COMPOUNDS

Gaskets and insulating compounds shall be nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds shall be non running after drying.

## 2.11 VAPOR RETARDER

### 2.11.1 Vapor Retarders Separate from Insulation

Vapor retarder material shall be polyethylene sheeting conforming to ASTM D 4397. A single ply of 10 mil polyethylene sheet; or, at the Contractor's option, a double ply of 6 mil polyethylene sheet shall be used. A fully compatible polyethylene tape which has equal or better water vapor control characteristics than the vapor retarder material shall be provided. A cloth industrial duct tape in a utility grade shall also be provided to use as needed to protect the vapor retarder from puncturing.

### 2.11.2 Slip Sheet for Use With Vapor Retarder

Slip sheet for use with vapor retarder shall be a 5 lb. per 100 square feet rosin-sized, unsaturated building paper.

## 2.12 EPDM RUBBER BOOTS

Flashing devices around pipe penetrations shall be flexible, one-piece devices molded from weather-resistant EPDM rubber. Rubber boot material shall be as recommended by the manufacturer. The boots shall have base rings made of corrosion resisting steel that conform to the contours of the roof panel to form a weather-tight seal.

## 2.13 ICE AND WATERPROOF SHEET UNDERLAYMENT

Waterproof sheet underlayment shall be in accordance with the approved erection instructions and drawings. Membrane shall be a flexible composite of polyethylene sheeting and rubberized asphalt with a minimum total

membrane thickness of 40 mils. Membrane shall be self-sealing with a self adhesive backing that is repositionable.

#### 2.14 Snow Guards

Snow guards shall be a low profile snow retention system. The snow guard system shall be designed specifically to accommodate standing seam metal roofs without causing damage to the roof. The aluminum alloy system shall have a single, tubular snow guard bar running perpendicular to the standing seams. The retention clamps shall be anchored (set screws) only to the roof standing seam, which holds the snow guard bar system. The anchoring shall not penetrate the standing seam roof and/or legs. The entire snow guard system shall have a Kynar (minimum 2 mil dry film thickness) painted finish to match the standing seam metal roof. The snow guard manufacturer shall have been in the business of fabricating snow guards for a minimum of 5 years.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Installation shall be in accordance with the manufacturer's erection instructions and drawings. Dissimilar materials which are not compatible when contacting each other shall be insulated by means of gaskets or insulating compounds. Molded closure strips shall be installed wherever roofing sheets terminate in open-end configurations, exclusive of flashings. The closure strip installation shall be weather-tight and sealed. Screws shall be installed with a clutching screw gun, to assure screws are not stripped. Field test shall be conducted on each gun prior to starting installation and periodically thereafter to assure it is adjusted properly to install particular type and size of screw as recommended by manufacturer's literature. Improper or mislocated drill holes shall be plugged with an oversize screw fastener and gasketed washer; however, sheets with an excess of such holes or with such holes in critical locations shall not be used. Exposed surfaces and edges shall be kept clean and free from sealant, metal cuttings, hazardous burrs, and other foreign material. Stained, discolored, or damaged sheets shall be removed from the site.

##### 3.1.1 Field Forming of Panels for Unique Area

When roofing panels are formed from factory-color-finished steel coils at the project site, the same care and quality control measures that are taken in shop forming of roofing panels shall be observed. Rollformer shall be operated by the metal roofing manufacturer's representative. In cold weather conditions, preheating of the steel coils to be field formed shall be performed as necessary just prior to the rolling operations.

##### 3.1.2 Subpurlins

Unless otherwise shown, subpurlins shall be anchored to the purlins or other structural framing members with bolts or screws. Attachment to the substrate (when provided) or to the panels is not permitted. The subpurlin spacing shall not exceed 30 inches on centers at the corner, edge and ridge zones, and 5 foot maximum on centers for the remainder of the roof. Corner, edge, and ridge zones are as defined in ASCE 7.

##### 3.1.3 Roof Panel Installation

Roof panels shall be installed with the standing seams in the direction of the roof slope. The side seam connections for installed panels shall be completed at the end of each day's work. Method of applying joint sealant shall conform to the manufacturer's recommendation to achieve a complete weather-tight installation. End laps of panels shall be provided in accordance with the manufacturer's instructions. Closures, flashings, EPDM rubber boots, roof curbs, and related accessories shall be installed according to the manufacturer's drawings. Fasteners shall not puncture roofing sheets except as provided for in the manufacturer's instructions for erection and installation. Expansion joints for the standing seam roof system shall be installed at locations indicated on the contract drawings and other locations indicated on the manufacturer's drawings.

#### 3.1.4 Concealed Anchor Clips

Concealed anchor clips shall be fastened directly to the structural framing members. Attachment to the substrate (when provided) or to the metal deck is not permitted. The maximum distance, parallel to the seams, between clips shall be 30 inches on center at the corner, edge, and ridge zones, and 5 feet maximum on centers for the remainder of the roof.

### 3.2 INSULATION INSTALLATION

Insulation shall be continuous over entire roof surface. Where expansion joints, terminations, and other connections are made, the cavity shall be filled with batt insulation with vapor retarder providing equivalent R-value and perm rating as remaining insulation. Insulation shall be installed as indicated and in accordance with manufacturer's instructions.

#### 3.2.1 Board Insulation with Blanket Insulation

Rigid or semirigid board insulation shall be laid in close contact. Board shall be attached to the metal roof deck with bearing plates and fasteners, as recommended by the insulation manufacturer, so that the insulation joints are held tight against each other, and shall have a minimum of 1 fastener per 4 square feet. Layout and joint pattern of insulation and fasteners shall be indicated on the shop drawings. If more than one layer of insulation is required, joints in the second layer shall be offset from joints in the first layer. A layer of blanket insulation shall be placed over the rigid or semirigid board insulation to be compressed against the underside of the metal roofing to reduce thermal bridging, dampen noise, and prevent roofing flutter. This layer of blanket insulation shall be compressed a minimum of 50 percent. Although drawings show rigid insulation tight against the metal standing seam metal roof, this does not eliminate the Contractor's responsibility from adding the batt insulation to fill the void as described.

### 3.3 PROTECTION OF VAPOR RETARDER FROM ROOF DECK

A cloth industrial duct tape shall be applied over the seams of metal roof decks, at penetration edges, and at surface areas exhibiting sharp burrs or similar protrusions. For other types of roof decks, cloth industrial duct tape shall be applied over irregularities which could potentially puncture polyethylene membrane.

### 3.4 VAPOR RETARDER INSTALLATION

#### 3.4.1 Polyethylene Vapor Retarder

The polyethylene vapor retarder membrane shall be installed over the entire surface. A fully compatible polyethylene tape shall be used to seal the edges of the sheets to provide a vapor tight membrane. Sheet edges shall be lapped not less than 6 inches. Sufficient material shall be provided to avoid inducing stresses in the sheets due to stretching or binding. All tears or punctures that are visible in the finished surface at any time during the construction process shall be sealed with polyethylene tape.

### 3.5 SLIP SHEET INSTALLATION

A slip sheet shall be laid over the blanket insulation facing to prevent the vinyl facing from adhering to the metal roofing.

### 3.6 ICE AND WATERPROOF SHEET UNDERLAYMENT

Waterproof sheet underlayment shall be installed as indicated on the drawings. The underlayment sheet shall be applied with adhesive surface against the roof rigid insulation. Underlayment shall extend a minimum of:

- 3 feet up the roof from gutter edge locations,
- 3 feet on each side of roof ridge locations,
- 3 feet diameter around all vent and pipe penetration locations,
- 3 feet on each side of hip & hip ridge locations,
- 3 feet from all rake edge locations,
- 3 feet from all roff wall connection locations,
- 6 feet on each side of valley locations.

All end laps or edge laps shall be a minimum of 6 inches. Manufacturer's installation instructions shall govern application procedures.

### 3.7 Snow Guards

Snow guards shall be installed in accordance with manufacturer's instructions. Manufacturer shall warranty all metal products be free from defects caused by the manufacturing process.

### 3.8 CLEANING AND TOUCH-UP

Exposed SSSMR systems shall be cleaned at completion of installation. Debris that could cause discoloration and harm to the panels, flashings, closures and other accessories shall be removed. Grease and oil films, excess sealants, and handling marks shall be removed and the work shall be scrubbed clean. Exposed metal surfaces shall be free of dents, creases, waves, scratch marks, and solder or weld marks. Immediately upon detection, abraded or corroded spots on shop-painted surfaces shall be wire brushed and touched up with the same material used for the shop coat. Factory color finished surfaces shall be touched up with the manufacturer's recommended touch up paint.

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY  
FOR  
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM

FACILITY DESCRIPTION \_\_\_\_\_

BUILDING NUMBER: \_\_\_\_\_

CORPS OF ENGINEERS CONTRACT NUMBER: \_\_\_\_\_

CONTRACTOR

CONTRACTOR: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

POINT OF CONTACT: \_\_\_\_\_

TELEPHONE NUMBER: \_\_\_\_\_

OWNER

OWNER: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

POINT OF CONTACT: \_\_\_\_\_

TELEPHONE NUMBER: \_\_\_\_\_

CONSTRUCTION AGENT

CONSTRUCTION AGENT: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

POINT OF CONTACT: \_\_\_\_\_

TELEPHONE NUMBER: \_\_\_\_\_

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY  
FOR  
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM  
(continued)

THE SSSMR SYSTEM INSTALLED ON THE ABOVE NAMED BUILDING IS WARRANTED BY \_\_\_\_\_ FOR A PERIOD OF FIVE (5) YEARS AGAINST WORKMANSHIP AND MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE. THE SSSMR SYSTEM COVERED UNDER THIS WARRANTY SHALL INCLUDE, BUT SHALL NOT BE LIMITED TO, THE FOLLOWING: THE ENTIRE ROOFING SYSTEM, MANUFACTURER SUPPLIED FRAMING AND STRUCTURAL MEMBERS, METAL ROOF PANELS, FASTENERS, CONNECTORS, ROOF SECUREMENT COMPONENTS, AND ASSEMBLIES TESTED AND APPROVED IN ACCORDANCE WITH ASTM E 1592. IN ADDITION, THE SYSTEM PANEL FINISHES, SLIP SHEET, INSULATION, VAPOR RETARDER, ALL ACCESSORIES, COMPONENTS, AND TRIM AND ALL CONNECTIONS ARE INCLUDED. THIS INCLUDES ROOF PENETRATION ITEMS SUCH AS VENTS, CURBS, SKYLIGHTS; INTERIOR OR EXTERIOR GUTTERS AND DOWNSPOUTS; EAVES, RIDGE, HIP, VALLEY, RAKE, GABLE, WALL, OR OTHER ROOF SYSTEM FLASHINGS INSTALLED AND ANY OTHER COMPONENTS SPECIFIED WITHIN THIS CONTRACT TO PROVIDE A WEATHERTIGHT ROOF SYSTEM; AND ITEMS SPECIFIED IN OTHER SECTIONS OF THE SPECIFICATIONS THAT ARE PART OF THE SSSMR SYSTEM.

ALL MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE ASSOCIATED WITH THE SSSMR SYSTEM COVERED UNDER THIS WARRANTY SHALL BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER. THIS WARRANTY SHALL COVER THE ENTIRE COST OF REPAIR OR REPLACEMENT, INCLUDING ALL MATERIAL, LABOR, AND RELATED MARKUPS. THE ABOVE REFERENCED WARRANTY COMMENCED ON THE DATE OF FINAL ACCEPTANCE ON \_\_\_\_\_ AND WILL REMAIN IN EFFECT FOR STATED DURATION FROM THIS DATE.

SIGNED, DATED, AND NOTARIZED (BY COMPANY PRESIDENT)

\_\_\_\_\_  
(Company President) (Date)

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY  
FOR  
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM  
(continued)

THE CONTRACTOR SHALL SUPPLEMENT THIS WARRANTY WITH WRITTEN WARRANTIES FROM THE MANUFACTURER AND/OR INSTALLER OF THE SSSMR SYSTEM, WHICH SHALL BE SUBMITTED ALONG WITH THE CONTRACTOR'S WARRANTY. HOWEVER, THE CONTRACTOR WILL BE ULTIMATELY RESPONSIBLE FOR THIS WARRANTY AS OUTLINED IN THE SPECIFICATIONS AND AS INDICATED IN THIS WARRANTY EXAMPLE.

EXCLUSIONS FROM COVERAGE

1. NATURAL DISASTERS, ACTS OF GOD (LIGHTNING, FIRE, EXPLOSIONS, SUSTAINED WIND FORCES IN EXCESS OF THE DESIGN CRITERIA, EARTHQUAKES, AND HAIL).
2. ACTS OF NEGLIGENCE OR ABUSE OR MISUSE BY GOVERNMENT OR OTHER PERSONNEL, INCLUDING ACCIDENTS, VANDALISM, CIVIL DISOBEDIENCE, WAR, OR DAMAGE CAUSED BY FALLING OBJECTS.
3. DAMAGE BY STRUCTURAL FAILURE, SETTLEMENT, MOVEMENT, DISTORTION, WARPAGE, OR DISPLACEMENT OF THE BUILDING STRUCTURE OR ALTERATIONS MADE TO THE BUILDING.
4. CORROSION CAUSED BY EXPOSURE TO CORROSIVE CHEMICALS, ASH OR FUMES GENERATED OR RELEASED INSIDE OR OUTSIDE THE BUILDING FROM CHEMICAL PLANTS, FOUNDRIES, PLATING WORKS, KILNS, FERTILIZER FACTORIES, PAPER PLANTS, AND THE LIKE.
5. FAILURE OF ANY PART OF THE SSSMR SYSTEM DUE TO ACTIONS BY THE OWNER TO INHIBIT FREE DRAINAGE OF WATER FROM THE ROOF AND GUTTERS AND DOWNSPOUTS OR ALLOW PONDING WATER TO COLLECT ON THE ROOF SURFACE. CONTRACTOR'S DESIGN SHALL INSURE FREE DRAINAGE FROM THE ROOF AND NOT ALLOW PONDING WATER.
6. THIS WARRANTY APPLIES TO THE SSSMR SYSTEM. IT DOES NOT INCLUDE ANY CONSEQUENTIAL DAMAGE TO THE BUILDING INTERIOR OR CONTENTS WHICH IS COVERED BY THE WARRANTY OF CONSTRUCTION CLAUSE INCLUDED IN THIS CONTRACT.
7. THIS WARRANTY CANNOT BE TRANSFERRED TO ANOTHER OWNER WITHOUT WRITTEN CONSENT OF THE CONTRACTOR; AND THIS WARRANTY AND THE CONTRACT PROVISIONS WILL TAKE PRECEDENCE OVER ANY CONFLICTS WITH STATE STATUTES.

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CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY  
FOR  
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM  
(continued)

\*\*REPORTS OF LEAKS AND SSSMR SYSTEM DEFICIENCIES SHALL BE RESPONDED TO WITHIN 48 HOURS OF RECEIPT OF NOTICE, BY TELEPHONE OR IN WRITING, FROM EITHER THE OWNER OR CONTRACTING OFFICER. EMERGENCY REPAIRS TO PREVENT FURTHER ROOF LEAKS SHALL BE INITIATED IMMEDIATELY; A WRITTEN PLAN SHALL BE SUBMITTED FOR APPROVAL TO REPAIR OR REPLACE THIS SSSMR SYSTEM WITHIN SEVEN (7) CALENDAR DAYS. ACTUAL WORK FOR PERMANENT REPAIRS OR REPLACEMENT SHALL BE STARTED WITHIN 30 DAYS AFTER RECEIPT OF NOTICE, AND COMPLETED WITHIN A REASONABLE TIME FRAME. IF THE CONTRACTOR FAILS TO ADEQUATELY RESPOND TO THE WARRANTY PROVISIONS, AS STATED IN THE CONTRACT AND AS CONTAINED HEREIN, THE CONTRACTING OFFICER MAY HAVE THE SSSMR SYSTEM REPAIRED OR REPLACED BY OTHERS AND CHARGE THE COST TO THE CONTRACTOR.

IN THE EVENT THE CONTRACTOR DISPUTES THE EXISTENCE OF A WARRANTABLE DEFECT, THE CONTRACTOR MAY CHALLENGE THE OWNER'S DEMAND FOR REPAIRS AND/OR REPLACEMENT DIRECTED BY THE OWNER OR CONTRACTING OFFICER EITHER BY REQUESTING A CONTRACTING OFFICER'S DECISION UNDER THE CONTRACT DISPUTES ACT, OR BY REQUESTING THAT AN ARBITRATOR RESOLVE THE ISSUE. THE REQUEST FOR AN ARBITRATOR MUST BE MADE WITHIN 48 HOURS OF BEING NOTIFIED OF THE DISPUTED DEFECTS. UPON BEING INVOKED, THE PARTIES SHALL, WITHIN TEN (10) DAYS, JOINTLY REQUEST A LIST OF FIVE (5) ARBITRATORS FROM THE FEDERAL MEDIATION AND CONCILIATION SERVICE. THE PARTIES SHALL CONFER WITHIN TEN (10) DAYS AFTER RECEIPT OF THE LIST TO SEEK AGREEMENT ON AN ARBITRATOR. IF THE PARTIES CANNOT AGREE ON AN ARBITRATOR, THE CONTRACTING OFFICER AND THE PRESIDENT OF THE CONTRACTOR'S COMPANY WILL STRIKE ONE (1) NAME FROM THE LIST ALTERNATIVELY UNTIL ONE (1) NAME REMAINS. THE REMAINING PERSON SHALL BE THE DULY SELECTED ARBITRATOR. THE COSTS OF THE ARBITRATION, INCLUDING THE ARBITRATOR'S FEE AND EXPENSES, COURT REPORTER, COURTROOM OR SITE SELECTED, ETC., SHALL BE BORNE EQUALLY BETWEEN THE PARTIES. EITHER PARTY DESIRING A COPY OF THE TRANSCRIPT SHALL PAY FOR THE TRANSCRIPT. A HEARING WILL BE HELD AS SOON AS THE PARTIES CAN MUTUALLY AGREE. A WRITTEN ARBITRATOR'S DECISION WILL BE REQUESTED NOT LATER THAN 30 DAYS FOLLOWING THE HEARING. THE DECISION OF THE ARBITRATOR WILL NOT BE BINDING; HOWEVER, IT WILL BE ADMISSIBLE IN ANY SUBSEQUENT APPEAL UNDER THE CONTRACT DISPUTES ACT.

A FRAMED COPY OF THIS WARRANTY SHALL BE POSTED IN THE MECHANICAL ROOM OR OTHER APPROVED LOCATION DURING THE ENTIRE WARRANTY PERIOD.

-- End of Section --

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DIVISION 07 - THERMAL & MOISTURE PROTECTION

SECTION 07600A

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11/01

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## SECTION 07600A

SHEET METALWORK, GENERAL  
11/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 167	(1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM B 209	(2000) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 221	(2000) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B 32	(1996) Solder Metal
ASTM B 370	(1998) Copper Sheet and Strip for Building Construction
ASTM D 226	(1997a) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

## INSECT SCREENING WEAVERS ASSOCIATION (ISWA)

ISWA IWS 089	(1990) Recommended Standards and Specifications for Insect Wire Screening (Wire Fabric)
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## SHEET METAL &amp; AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA Arch. Manual	(1993; Errata; Addenda Oct 1997) Architectural Sheet Metal Manual
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## 1.2 GENERAL REQUIREMENTS

Sheet metalwork shall be accomplished to form weathertight construction without waves, warps, buckles, fastening stresses or distortion, and shall allow for expansion and contraction. Cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades shall be performed by sheet metal mechanics. Installation of sheet metal items used in conjunction with roofing shall be coordinated with roofing work to permit continuous roofing operations. Sheet metalwork pertaining to heating, ventilating, and air conditioning is

specified in Section 15895.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

##### Materials; G-DO

Drawings of sheet metal items showing weights, gauges or thicknesses; types of materials; expansion-joint spacing; fabrication details; and installation procedures.

### 1.4 DELIVERY, STORAGE, AND HANDLING

Materials shall be adequately packaged and protected during shipment and shall be inspected for damage, dampness, and wet-storage stains upon delivery to the jobsite. Materials shall be clearly labeled as to type and manufacturer. Sheet metal items shall be carefully handled to avoid damage. Materials shall be stored in dry, ventilated areas until immediately before installation.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Lead, lead-coated metal, and galvanized steel shall not be used. Any metal listed by SMACNA Arch. Manual for a particular item may be used, unless otherwise specified or indicated. Materials shall conform to the requirements specified below and to the thicknesses and configurations established in SMACNA Arch. Manual. Different items need not be of the same metal, except that if copper is selected for any exposed item, all exposed items shall be copper.

#### 2.1.1 Accessories

Accessories and other items essential to complete the sheet metal installation, though not specifically indicated or specified, shall be provided.

#### 2.1.2 Aluminum Extrusions

ASTM B 221, Alloy 6063, Temper T5.

#### 2.1.3 Sealant

Unless otherwise specified, sealant shall be an elastomeric weather resistant sealant as specified in Section 07900A JOINT SEALING.

#### 2.1.4 Fasteners

Fasteners shall be compatible with the fastened material and shall be the type best suited for the application.

## 2.1.5 Felt

ASTM D 226, Type I.

## 2.1.6 Aluminum Alloy Sheet and Plate

ASTM B 209, anodized clear- in non exposed areas and painted to match adjacent surfaces in exposed areas, form, alloy, and temper appropriate for use.

## 2.1.7 Copper

ASTM B 370, Temper H 00.

## 2.1.8 Stainless Steel

ASTM A 167, Type 302 or 304; fully annealed, dead soft temper.

## 2.1.9 Solder

ASTM B 32, 95-5 tin-antimony.

## 2.1.10 Through-Wall Flashing

- a. (use at screen walls, concrete foundations and other locations where flashings will not be exposed to view) Electro-sheet copper not less than 5 ounces, factory coated both sides with acid- and alkali-resistant bituminous compound not less than 6 ounces per square foot or factory covered both sides with asphalt-saturated cotton fabric, asphalt saturated glass-fiber fabric, or with 40 pound reinforced kraft paper bonded with asphalt.
- b. (use at window, louver, door locations and other areas where flashing will be exposed to view) Stainless steel, Type 304, not less than 0.01 inch thick.
- c. (use at screen walls, concrete foundations and other locations where flashings will not be exposed to view) Stainless steel, Type 304, not less than 0.01 inch thick, completely encased by and permanently bonded on both sides to 50 pound high strength bituminized crepe kraft paper, using hot asphalt, heat, and pressure.

## 2.1.11 Louver Screen

Type III aluminum alloy insect screening conforming to ISWA IWS 089.

## PART 3 EXECUTION

## 3.1 GENERAL REQUIREMENTS

Gutters and downspouts shall be designed and fabricated in conformance with SMACNA Arch. Manual; louvers shall be fabricated in conformance with SMACNA Arch. Manual and as indicated. Unless otherwise specified or indicated, exposed edges shall be folded back to form a 1/2 inch hem on the concealed side, and bottom edges of exposed vertical surfaces shall be angled to form drips.

## 3.2 EXPANSION JOINTS

Expansion joints shall be provided as specified in SMACNA Arch. Manual. Expansion joints in continuous sheet metal shall be provided at 40 foot intervals for copper and stainless steel and at 32 foot intervals for aluminum. Joints shall be evenly spaced. An additional joint shall be provided where the distance between the last expansion joint and the end of the continuous run is more than half the required interval spacing.

### 3.3 PROTECTION OF ALUMINUM

Aluminum shall not be used where it will be in contact with copper or where it will contact water which flows over copper surfaces. Aluminum that will be in contact with wet or pressure-treated wood, mortar, concrete, masonry, or ferrous metals shall be protected against galvanic or corrosive action by one of the following methods:

#### 3.3.1 Paint

Aluminum surfaces shall be solvent cleaned and given one coat of zinc-molybdate primer and one coat of aluminum paint as specified in Section 09900 PAINTING, GENERAL.

#### 3.3.2 Nonabsorptive Tape or Gasket

Nonabsorptive tape or gasket shall be placed between the adjoining surfaces and cemented to the aluminum surface using a cement compatible with aluminum.

### 3.4 CONNECTIONS AND JOINTING

#### 3.4.1 Soldering

Soldering shall apply to copper, and stainless steel items. Edges of sheet metal shall be pretinned before soldering is begun. Soldering shall be done slowly with well heated soldering irons so as to thoroughly heat the seams and completely sweat the solder through the full width of the seam. Edges of stainless steel to be pretinned shall be treated with soldering acid flux. Soldering shall follow immediately after application of the flux. Upon completion of soldering, the acid flux residue shall be thoroughly cleaned from the sheet metal with a water solution of washing soda and rinsed with clean water.

#### 3.4.2 Riveting

Joints in aluminum sheets 0.040 inch or less in thickness shall be mechanically made.

#### 3.4.3 Seaming

Flat-lock and soldered-lap seams shall finish not less than 1 inch wide. Unsoldered plain-lap seams shall lap not less than 3 inches unless otherwise specified. Flat seams shall be made in the direction of the flow.

### 3.5 CLEATS

A continuous cleat shall be provided where indicated or specified to secure loose edges of the sheet metalwork. Butt joints of cleats shall be spaced approximately 1/8 inch apart. The cleat shall be fastened to supporting wood construction with nails evenly spaced not over 12 inches on centers.

Where the fastening is to be made to concrete or masonry, screws shall be used and shall be driven in expansion shields set in concrete or masonry.

### 3.6 GUTTERS AND DOWNSPOUTS

Gutters and downspouts shall be installed as indicated. Gutters shall be supported as indicated and by cleats spaced not less than 36 inches apart. Downspouts shall be rigidly attached to the building. Supports for downspouts shall be spaced according to manufacturer's recommendations.

### 3.7 FLASHINGS

Flashings shall be installed at locations indicated and as specified below.

Sealing shall be according to the flashing manufacturer's recommendations.

Flashings shall be installed at intersections of roof with vertical surfaces and at projections through roof, except that flashing for heating and plumbing, including piping, roof, and floor drains, and for electrical conduit projections through roof or walls are specified in other sections. Except as otherwise indicated, counter flashings shall be provided over base flashings. Perforations in flashings made by masonry anchors shall be covered up by an application of bituminous plastic cement at the perforation. Flashing shall be installed on top of joint reinforcement. Flashing shall be formed to direct water to the outside of the system.

#### 3.7.1 Base Flashing

Metal base flashing shall be coordinated with roofing work.

#### 3.7.2 Counter Flashings

Except as otherwise indicated, counter flashings shall be provided over base flashings. Counter flashing shall be installed as shown on the drawings. Counter flashing shall be factory formed to provide spring action against the base flashing.

#### 3.7.3 Through-Wall Flashing

Through-wall flashing includes sill, lintel, and spandrel flashing. The flashing shall be laid with a layer of mortar above and below the flashing so that the total thickness of the two layers of the mortar and flashing are the same thickness as the regular mortar joints. Flashing shall not extend further into the masonry backup wall than the first mortar joint. Joints in flashing shall be lapped and sealed. Flashing shall be one piece for lintels and sills.

##### 3.7.3.1 Lintel Flashing

Lintel flashing shall extend the full length of lintel. Flashing shall extend through the wall one masonry course above the lintels and shall be bent down over the vertical leg of the outer steel lintel angle not less than 2 inches, or shall be applied over top of masonry and precast concrete lintels. Bedjoints of lintels at control joints shall be underlaid with sheet metal bond breaker.

##### 3.7.3.2 Sill Flashing

Sill flashing shall extend the full width of the sill and not less than 4 inches beyond ends of sill except at control joint where the flashing shall be terminated at the end of the sill.

#### 3.7.4 Valley Flashing

Valley flashing shall be installed as specified in SMACNA Arch. Manual and as indicated and coordinated with the roofing system.

#### 3.8 INSTALLATION OF LOUVERS

Louvers shall be rigidly attached to the supporting construction. The installation shall be rain-tight. Louver screen shall be installed as indicated.

#### 3.9 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure for sheet metal used in conjunction with roofing to assure compliance of the installed sheet metalwork with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

- a. Observation of environmental conditions; number and skill level of sheet metal workers; condition of substrate.
- b. Verification of compliance of materials before, during, and after installation.
- c. Inspection of sheet metalwork for proper size and thickness, fastening and joining, and proper installation.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer at the end of each day.

-- End of Section --

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SECTION 07810

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08/02

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## SECTION 07810

SPRAY-APPLIED FIREPROOFING  
08/02

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 1042	(1992; R 1997e1) Acoustically Absorptive Materials Applied by Trowel or Spray
ASTM E 119	(2000) Fire Tests of Building Construction and Materials
ASTM E 605	(1993; R 1996) Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members
ASTM E 736	(1992) Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
ASTM E 759	(1992; R 1996) Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members
ASTM E 760	(1992; R 1996e1) Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members
ASTM E 761	(1992) Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members
ASTM E 84	(2000a) Surface Burning Characteristics of Building Materials
ASTM E 859	(1993) Air Erosion of Sprayed Fire-Resistive Materials (SFRMS) Applied to Structural Members
ASTM E 937	(1993) Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members
ASTM G 21	(1996) Determining Resistance of Synthetic Polymeric Materials to Fungi

## UNDERWRITERS LABORATORIES (UL)

UL 263 (1997; Rev thru Jun 1998) Fire Tests of Building Construction and Materials

UL Fire Resist Dir (1999) Fire Resistance Directory (2 Vol.)

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### SD-03 Product Data

Fireproofing Material; G-DO

Data identifying performance characteristics of fireproofing material. Data shall include recommended application requirements and indicate thickness of fireproofing that must be applied to achieve each required fire rating.

### SD-06 Test Reports

Fire Resistance Rating; G-AO

Reports and test records, attesting that the fireproofing material conforms to the specified requirements. Each test report shall conform to the report requirements specified by the test method.

### SD-07 Certificates

Installer Qualifications;

Manufacturer's certification that each listed installer is qualified and trained to install the specified fireproofing. Evidence that each fireproofing installer has had a minimum of 3 years experience in installing the specified type of fireproofing.

## 1.3 DELIVERY AND STORAGE

Packaged material shall be delivered in the original unopened containers, marked to show the brand name, the manufacturer, and the UL markings. Fireproofing material shall be kept dry until ready to be used, and shall be stored off the ground, under cover and away from damp surfaces. Damaged or opened containers will be rejected. Material with shelf-life shall be applied prior to expiration of the shelf-life.

## 1.4 ENVIRONMENTAL CONDITIONS

### 1.4.1 Temperature

Substrate and ambient air temperatures shall be maintained above 40 degrees F during application and for 24 hours before and after application. Relative humidity shall be maintained within the limits recommended by the fireproofing manufacturer.

#### 1.4.2 Ventilation

Adequate ventilation shall be provided to properly dry the fireproofing after application. In enclosed areas, a minimum of 4 air exchanges per hour shall be provided by forced air circulation.

#### 1.5 INSTALLER QUALIFICATIONS

Engage an experienced installer that is certified, licensed, or otherwise qualified by the spray-on fireproofing manufacturer as having the necessary experience, staff, and training to install the manufacturer's products in accordance with specified requirements. Each installer of fireproofing material shall be trained, have a minimum of 3 years experience and a minimum of three installations using fireproofing of the type specified. A manufacturer's willingness to sell its products to the Contractor or installer does not infer qualification of the buyer.

#### 1.6 FIRE RESISTANCE RATING

Fire resistance ratings shall be in accordance with the fire rated assemblies listed in UL Fire Resist Dir. Proposed materials not listed in UL Fire Resist Dir shall have fire resistance ratings at least equal to the UL Fire Resist Dir ratings as determined by an approved independent testing laboratory, based on tests specified in UL 263 or ASTM E 119. Fireproofing shall be applied to structural steel members, with the following hourly fire resistance rating and in accordance with the UL design or approved equivalent. Use unrestrained fire resistance ratings, unless the architect/engineer has specified that the degree of thermal restraint of the construction meets or exceeds the degree of thermal restraint of the tested assembly. Performance tests shall be in accordance with ASTM E 119.

	<u>Fire Rating Schedule</u>
	Hourly
Floor decks	One
Floor supports	One

#### 1.7 EXTENT OF FIREPROOFING

All structural steel floor beams and the undersides of steel floor mezzanine over room numbers- 106, 107, 108, 109, 111 & 112 shall be protected with spray-applied fireproofing to a fire resistance hour-rating as indicated in the preceding paragraph.

#### 1.8 PRE-INSTALLATION CONFERENCE

The Contractor shall hold a meeting with the installer, subcontractors (whose employees come into contact with the fireproofing), and the Contracting Officer prior to the installation of any fireproofing material to review the substrates for acceptability, method of application, applied thickness, patching, repair, inspection and testing procedures.

### PART 2 PRODUCTS

#### 2.1 SPRAY-APPLIED FIREPROOFING

Spray-applied fireproofing material, including sealer, shall conform to

ASTM E 1042, Class (a), Category A, either Type I or Type II, except that the dust removed shall not exceed 0.0025 gram per square foot of fireproofing material applied as specified in the project. Material shall be asbestos free, and shall resist fungus for a period of 28 days when tested in accordance with ASTM G 21. Material shall have a flame spread of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E 84.

#### 2.1.1 Dry Density and Cohesion/Adhesion

Fireproofing shall have a minimum ASTM E 605 dry density and ASTM E 736 cohesion/adhesion properties as follows:

##### 2.1.1.1 Concealed Structural Components

Fireproofing for structural components concealed above the ceiling, shall have a minimum applied dry density of 15 pounds per cubic foot and a cohesion/adhesion strength of 200 psf.

#### 2.1.2 Deflection

Spray-applied fireproofing shall not crack, spall, or delaminate when backing to which it is applied is subject to downward deflection 1/120 of 10 foot clear span, when tested in accordance with ASTM E 759.

#### 2.1.3 Bond-Impact

Spray-applied fireproofing material shall not crack, spall or delaminate when tested in accordance with ASTM E 760.

#### 2.1.4 Compressive Strength

The minimum compressive strength shall be 1000 psf when tested in accordance with ASTM E 761.

#### 2.1.5 Corrosion

Spray-applied fireproofing material shall not contribute to corrosion of test panels when tested as specified in ASTM E 937.

#### 2.1.6 Air Erosion

Dust removal shall not exceed 0.025 gram per square foot when tested in accordance with ASTM E 859.

### 2.2 SEALER

Sealer shall be the type approved by the manufacturer of the fireproofing material, shall be fungus resistant, shall have a flame spread of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E 84, and shall be a contrasting color with the fireproofing.

### 2.3 WATER

Water used for material mixing and surface preparation shall be potable.

## PART 3 EXECUTION

### 3.1 SURFACE PREPARATION

Surfaces to be fireproofed shall be thoroughly cleaned of dirt, grease, oil, paint, primers, loose rust, rolling lubricant, mill scale or other contaminants that will interfere with the proper bonding of the sprayed fireproofing to the substrate. Painted/primed steel substrates shall be tested in accordance with ASTM E 736, with specified sprayed fireproofing material, to provide the required fire-resistance rating; painted or primed steel surfaces may require a fireproofing bond test to determine if the paint formulation will impair proper adhesion. The Contractor shall certify the acceptability of surfaces to receive sprayed-applied fireproofing and submit a Surface Preparation Report accordingly. Overhead areas to be fireproofed shall be cleared of all obstructions interfering with the uniform application of the spray-applied fireproofing. Hardware such as support sleeves, inserts, clips, hanger attachment devices and the like shall be installed prior to the application of the fireproofing. Condition of the surfaces shall be acceptable to the manufacturer prior to application of spray-applied fireproofing. Applications listed for use on primed surfaces shall be in accordance with the manufacturer's recommendations and standards, and detailed in submittal item SD-03 Product Data.

### 3.2 PROTECTION

Surfaces not to receive spray-applied fireproofing shall be covered to prevent contamination by splatter, rebound and overspray. Surfaces not to receive fireproofing shall be cleaned of fireproofing and sealer.

### 3.3 MIXING

Fireproofing material shall be mixed in accordance with the manufacturer's recommendations.

### 3.4 APPLICATION

#### 3.4.1 Sequence

Prior to application of fireproofing on each floor, the contractor shall inspect and approve application equipment, water supply and pressure, and the application procedures. Fireproofing that is required to be applied to the underside of steel floor assemblies, it shall be done only after respective floor construction is complete. No floor traffic shall be allowed during application and during a 7-day minimum curing period. Fireproofing material shall be applied prior to the installation of ductwork, piping and conduits which would interfere with uniform application of the fireproofing.

#### 3.4.2 Application Technique

Water pressure and volume shall be maintained to manufacturer's recommendations throughout the fireproofing application. Fireproofing material shall be applied to the thickness and density established for the specified fire resistance rating, in accordance with the procedure recommended by the manufacturer, and to a uniform density and texture. Fireproofing material shall not be tamped to achieve the desired density.

#### 3.4.3 Sealer Application

If sealer is required by the product used, it shall be applied after field testing has been conducted and after corrective measures and repairs, if

required, have been completed.

#### 3.4.4 Applied Thickness

The minimum average thickness shall be no less than 0.375 inches. Thicknesses shall not be less than required to achieve designated fire resistance ratings. If the specified thickness is greater than or equal to 1 inch, any individual measurement shall not be less than the specified thickness minus 0.25 inches. If the specified thickness is less than 1 inch, any individual measurement shall not be less than the specified thickness minus 25 percent.

#### 3.5 CLEANUP

Surfaces not indicated to receive fireproofing shall be thoroughly cleaned of sprayed material within a 24 hour period after application.

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SECTION 07840A

FIRESTOPPING

08/00

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## SECTION 07840A

## FIRESTOPPING

08/00

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 84	(1999) Surface Burning Characteristics of Building Materials
ASTM E 119	(1998) Fire Tests of Building Construction and Materials
ASTM E 814	(1997) Fire Tests of Through-Penetration Fire Stops
ASTM E 1399	(1997) Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems

## UNDERWRITERS LABORATORIES (UL)

UL 723	(1996; Rev thru Dec 1998) Test for Surface Burning Characteristics of Building Materials
UL 1479	(1994; Rev thru Feb 1998) Fire Tests of Through-Penetration Firestops
UL 2079	(1998) Tests for Fire Resistance of Building Joint Systems
UL Fire Resist Dir	(1999) Fire Resistance Directory (2 Vol.)

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Firestopping Materials; G-AO.

Detail drawings including manufacturer's descriptive data, typical details conforming to UL Fire Resist Dir or other details certified by another nationally recognized testing laboratory, installation instructions or UL listing details for a firestopping assembly in lieu of fire-test data or report. For those firestop applications for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgement, derived from similar UL system designs or other tests, shall be submitted for review and approval prior to installation. Submittal shall indicate the firestopping material to be provided for each type of application. When more than 5 penetrations or construction joints are to receive firestopping, drawings shall indicate location and type of application.

#### SD-07 Certificates

##### Firestopping Materials;

Certificates attesting that firestopping material complies with the specified requirements. In lieu of certificates, drawings showing UL classified materials as part of a tested assembly may be provided. Drawings showing evidence of testing by an alternate nationally recognized independent laboratory may be substituted.

##### Installer Qualifications; G-AO.

Documentation of training and experience.

##### Inspection;

Manufacturer's representative certification stating that firestopping work has been inspected and found to be applied according to the manufacturer's recommendations and the specified requirements.

### 1.3 GENERAL REQUIREMENTS

Firestopping shall consist of furnishing and installing tested and listed firestop systems, combination of materials, or devices to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions and ceiling assemblies, including through-penetrations and construction joints and gaps. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material shall not interfere with the required movement of the joint. Gaps requiring firestopping include gaps between the curtain wall and fire-rated ceilings. Rated wall locations have been identified on the drawings.

### 1.4 STORAGE AND DELIVERY

Materials shall be delivered in the original unopened packages or containers showing name of the manufacturer and the brand name. Materials shall be stored off the ground and shall be protected from damage and exposure to elements. Damaged or deteriorated materials shall be removed from the site.

### 1.5 INSTALLER QUALIFICATIONS

The Contractor shall engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary staff, training, and a minimum of 3 years experience in the installation of manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an installer engaged by the Contractor does not in itself confer qualification on the buyer. The Installer shall have been trained by a direct representative of the manufacturer (not distributor or agent) in the proper selection and installation procedures.

## 1.6 COORDINATION

The specified work shall be coordinated with other trades. Firestopping materials, at penetrations of pipes and ducts, shall be applied prior to insulating, unless insulation meets requirements specified for firestopping. Firestopping materials at building joints and construction gaps shall be applied prior to completion of enclosing walls or assemblies. Cast-in-place firestop devices shall be located and installed in place before concrete placement. Pipe, conduit or cable bundles shall be installed through cast-in-place device after concrete placement but before area is concealed or made inaccessible.

## PART 2 PRODUCTS

### 2.1 FIRESTOPPING MATERIALS

Firestopping materials shall consist of commercially manufactured, asbestos-free products complying with the following minimum requirements:

#### 2.1.1 Fire Hazard Classification

Material shall have a flame spread of 25 or less, and a smoke developed rating of 50 or less, when tested in accordance with ASTM E 84 or UL 723. Material shall be an approved firestopping material as listed in UL Fire Resist Dir or by a nationally recognized testing laboratory.

#### 2.1.2 Toxicity

Material shall be nontoxic to humans at all stages of application.

#### 2.1.3 Fire Resistance Rating

Firestopping will not be required to have a greater fire resistance rating than that of the assembly in which it is being placed.

##### 2.1.3.1 Through-Penetrations

Firestopping materials for through-penetrations, as described in paragraph GENERAL REQUIREMENTS, shall provide "F" and "T" fire resistance ratings in accordance with ASTM E 814 or UL 1479. Fire resistance ratings shall be as follows:

- a. Penetrations of Fire Resistance Rated Walls and Partitions: F Rating = Rating of wall or partition being penetrated.
- b. Penetrations of Fire Resistance Rated Ceiling Assemblies: F Rating = equals rating of highest adjacent wall rating, T Rating = equals rating of highest adjacent wall rating.

### 2.1.3.2 Construction Joints and Gaps

Fire resistance ratings of construction joints, as described in paragraph GENERAL REQUIREMENTS, and gaps such as those between roof decks and curtain walls shall be the same as the construction in which they occur. Construction joints and gaps shall be provided with firestopping materials and systems that have been tested per ASTM E 119 or UL 2079 to meet the required fire resistance rating. Systems installed at construction joints shall meet the cycling requirements of ASTM E 1399 or UL 2079.

## PART 3 EXECUTION

### 3.1 PREPARATION

Areas to receive firestopping shall be free of dirt, grease, oil, or loose materials which may affect the fitting or fire resistance of the firestopping system. For cast-in-place firestop devices, formwork or metal deck to receive device prior to concrete placement shall be sound and capable of supporting device.

### 3.2 INSTALLATION

Firestopping material shall completely fill void spaces regardless of geometric configuration, subject to tolerance established by the manufacturer. Firestopping shall be installed in accordance with manufacturer's written instructions. Tested and listed firestop systems shall be provided in the following locations:

- a. Penetrations of duct, conduit, tubing, cable and pipe through fire-resistance rated walls, partitions, and ceiling assemblies.
- b. Penetrations of vertical shafts such as pipe chases.
- c. Gaps at perimeter of fire-resistance rated walls and partitions, such as between the top of the walls and the bottom of roof decks.
- d. Other locations where required to maintain fire resistance rating of the construction.

#### 3.2.1 Insulated Pipes and Ducts

Thermal insulation shall be cut and removed where pipes or ducts pass through firestopping, unless insulation meets requirements specified for firestopping. Thermal insulation shall be replaced with a material having equal thermal insulating and firestopping characteristics.

#### 3.2.2 Fire Dampers

Fire dampers shall be installed and firestopped in accordance with Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

### 3.3 INSPECTION

Firestopped areas shall not be covered or enclosed until inspection is complete and approved. A manufacturer's representative shall inspect the applications initially to ensure adequate preparations (clean surfaces suitable for application, etc.) and periodically during the work to assure that the completed work has been accomplished according to the

manufacturer's written instructions and the specified requirements.

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SECTION 07900A

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06/97

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## SECTION 07900A

JOINT SEALING  
06/97

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 509	(1994) Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM C 570	(1995) Oil- and Resin-Base Caulking Compound for Building Construction
ASTM C 834	(1995) Latex Sealants
ASTM C 920	(1998) Elastomeric Joint Sealants
ASTM C 1085	(1991) Butyl Rubber-Based Solvent-Release Sealants
ASTM C 1184	(1995e1) Structural Silicone-Sealants
ASTM D 1056	(1998) Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1565	(1999) Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Open-Cell Foam)

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-03 Product Data

Backing; G-AO.

Bond-Breaker; G-AO.

Sealant; G-AO.

Manufacturer's descriptive data including storage requirements, shelf life, curing time, instructions for mixing and application,

and primer data (if required). A copy of the Material Safety Data Sheet shall be provided for each solvent, primer or sealant material.

#### SD-07 Certificates

##### Sealant;

Certificates of compliance stating that the materials conform to the specified requirements.

### 1.3 ENVIRONMENTAL REQUIREMENTS

The ambient temperature shall be within the limits of 40 to 90 degrees F when the sealants are applied.

### 1.4 DELIVERY AND STORAGE

Materials shall be delivered to the job in the manufacturer's original unopened containers. The container label or accompanying data sheet shall include the following information as applicable: manufacturer, name of material, formula or specification number, lot number, color, date of manufacture, mixing instructions, shelf life, and curing time at the standard conditions for laboratory tests. Materials shall be handled and stored to prevent inclusion of foreign materials. Materials shall be stored at temperatures between 40 and 90 degrees F unless otherwise specified by the manufacturer.

## PART 2 PRODUCTS

### 2.1 BACKING

Backing shall be 25 to 33 percent oversize for closed cell and 40 to 50 percent oversize for open cell material, unless otherwise indicated.

#### 2.1.1 Rubber

(A) Cellular rubber sponge backing shall be ASTM D 1056, Class A , Grade A, round cross section.

#### 2.1.2 PVC

(B) Polyvinyl chloride (PVC) backing shall be ASTM D 1565, Grade VO 12, open-cell foam, round cross section.

#### 2.1.3 Synthetic Rubber

(C) Synthetic rubber backing shall be ASTM C 509, Option I , Type II preformed rods or tubes.

#### 2.1.4 Neoprene

(D) Neoprene backing shall be ASTM D 1056, closed cell expanded neoprene cord Type 2, Class C, Grade 2C2.

### 2.2 BOND-BREAKER

Bond-breaker shall be as recommended by the sealant manufacturer to prevent adhesion of the sealant to backing or to bottom of the joint.

### 2.3 PRIMER

Primer shall be non-staining type as recommended by sealant manufacturer for the application.

### 2.4 CAULKING

(1) Oil- and resin-based caulking shall be ASTM C 570.

Uses: Metal thresholds and other locations where little joint movement is anticipated and not exposed to view.

### 2.5 SEALANT

#### 2.5.1 LATEX

(2) Latex Sealant shall be ASTM C 834.

Uses: Interior joints in field painted surfaces, between walls or partitions and adjacent casework, shelving, and similar items; perimeters of frames at doors, windows, and access panels, and other locations where small voids exist between materials to be painted not otherwise specified.

#### 2.5.2 ELASTOMERIC

Elastomeric sealants shall conform to ASTM C 920 and the following:

(3) Polyurethane sealant: Grade NS , Class 25 , Use T, NT & O.

(4) Silicone sealant: Type S , Grade NS , Class 25 , Use NT, M, G, A & O.

Uses: Exterior joints in aluminum curtain walls- sealant color shall match curtain wall framing and other exterior locations as recommended by sealant manufacturer. Interior- clear sealant; at joints around plumbing fixtures, joints at top and bottom of countertop backsplashes, and other locations as recommended by sealant manufacturer.

(5) Structural silicone sealant: ASTM C 1184, Type S, Use G.

Uses: Exterior and interior window joints to support glazing units as recommended by sealant manufacturer.

#### 2.5.3 BUTYL

(6) Butyl sealant shall be ASTM C 1085.

Uses: Exterior- metal gutter joints.

#### 2.5.4 Sealant for EIFS

(7) Sealant for EIFS shall be as specified in SECTION 07240 Exterior Insulation and Finish System.

### 2.6 SOLVENTS AND CLEANING AGENTS

Solvents, cleaning agents, and accessory materials shall be provided as recommended by the manufacturer.

### PART 3 EXECUTION

#### 3.1 GENERAL

##### 3.1.1 Surface Preparation

The surfaces of joints to receive sealant or caulk shall be free of all frost, condensation and moisture. Oil, grease, dirt, chalk, particles of mortar, dust, loose rust, loose mill scale, and other foreign substances shall be removed from surfaces of joints to be in contact with the sealant.

Oil and grease shall be removed with solvent and surfaces shall be wiped dry with clean cloths. For surface types not listed below, the sealant manufacturer shall be contacted for specific recommendations.

##### 3.1.2 Concrete and Masonry Surfaces

Where surfaces have been treated with curing compounds, oil, or other such materials, the materials shall be removed by sandblasting or wire brushing. Laitance, efflorescence and loose mortar shall be removed from the joint cavity.

##### 3.1.3 Steel Surfaces

Steel surfaces to be in contact with sealant shall be sandblasted or, if sandblasting would not be practical or would damage adjacent finish work, the metal shall be scraped and wire brushed to remove loose mill scale. Protective coatings on steel surfaces shall be removed by sandblasting or by a solvent that leaves no residue.

##### 3.1.4 Aluminum Surfaces

Aluminum surfaces to be in contact with sealants shall be cleaned of temporary protective coatings. When masking tape is used for a protective cover, the tape and any residual adhesive shall be removed just prior to applying the sealant. Solvents used to remove protective coating shall be as recommended by the manufacturer of the aluminum work and shall be non-staining.

##### 3.1.5 Wood Surfaces

Wood surfaces to be in contact with sealants shall be free of splinters and sawdust or other loose particles.

#### 3.2 APPLICATION

##### 3.2.1 Masking Tape

Masking tape shall be placed on the finish surface on one or both sides of a joint cavity to protect adjacent finish surfaces from primer or sealant smears. Masking tape shall be removed within 10 minutes after joint has been filled and tooled.

##### 3.2.2 Backing

Backing shall be installed to provide the indicated sealant depth. The installation tool shall be shaped to avoid puncturing the backing.

##### 3.2.3 Bond-Breaker

Bond-breaker shall be applied to fully cover the bottom of the joint without contaminating the sides where sealant adhesion is required.

#### 3.2.4 Primer

Primer shall be used on concrete masonry units, wood, or other porous surfaces in accordance with instructions furnished with the sealant. Primer shall be applied to the joint surfaces to be sealed. Surfaces adjacent to joints shall not be primed.

#### 3.2.5 Sealant

Sealant shall be used before expiration of shelf life. Multi-component sealants shall be mixed according to manufacturer's printed instructions. Sealant in guns shall be applied with a nozzle of proper size to fit the width of joint. Joints shall be sealed as detailed in the drawings. Sealant shall be forced into joints with sufficient pressure to expel air and fill the groove solidly. Sealant shall be installed to the indicated depth without displacing the backing. Unless otherwise indicated, specified, or recommended by the manufacturer, the installed sealant shall be dry tooled to produce a uniformly smooth surface free of wrinkles and to ensure full adhesion to the sides of the joint; the use of solvents, soapy water, etc., will not be allowed. Sealants shall be installed free of air pockets, foreign embedded matter, ridges and sags. Sealer shall be applied over the sealant when and as specified by the sealant manufacturer.

### 3.3 CLEANING

The surfaces adjoining the sealed joints shall be cleaned of smears and other soiling resulting from the sealant application as work progresses.

-- End of Section --

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DIVISION 08 - DOORS & WINDOWS

SECTION 08110

STEEL DOORS AND FRAMES

05/01

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## SECTION 08110

## STEEL DOORS AND FRAMES

## 05/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- |             |  |
|-------------|--|
| ANSI A250.4 | (1994) Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcings |
| ANSI A250.6 | (1997) Hardware on Standard Steel Doors (Reinforcement - Application)  |
| ANSI A250.8 | (1998) SDI-100 Recommended Specifications for Standard Steel Doors and Frames                                  |

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- |                   |  |
|-------------------|--|
| ASTM A 653/A 653M | (2000) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process                           |
| ASTM A 924/A 924M | (1999) General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process  |
| ASTM C 578        | (1995) Rigid, Cellular Polystyrene Thermal Insulation  |
| ASTM C 591        | (1994) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation  |
| ASTM C 612        | (1993) Mineral Fiber Block and Board Thermal Insulation  |
| ASTM D 2863       | (1997) Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)                         |
| ASTM E 283        | (1991) Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen |

## DOOR AND HARDWARE INSTITUTE (DHI)

DHI A115 (1991) Steel Door Preparation Standards  
(Consisting of A115.1 through A115.6 and  
A115.12 through A115.18)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (1999) Fire Doors and Fire Windows

NFPA 252 (1999) Standard Methods of Fire Tests of  
Door Assemblies

STEEL DOOR INSTITUTE (SDOI)

SDI 105 (1998) Recommended Erection Instructions  
for Steel Frames

SDI 111-F Recommended Existing Wall Anchors for  
Standard Steel Doors and Frames

SDI 113 (1979) Apparent Thermal Performance of  
STEEL DOOR and FRAME ASSEMBLIES

UNDERWRITERS LABORATORIES (UL)

UL 10B (1997) Fire Tests of Door Assemblies

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal  
Procedures."

SD-02 Shop Drawings

Doors; G-DO

Frames; G-DO

Accessories;

Weatherstripping; G-DO

Show elevations, construction details, metal gages, hardware  
provisions, method of glazing, and installation details.

Schedule of doors; G-DO

Schedule of frames; G-DO

Submit door and frame locations.

SD-03 Product Data

Doors; G-DO

Frames; G-DO

Accessories; G-DO

Submit manufacturer's descriptive literature for doors, frames, and accessories. Include data and details on door construction, panel (internal) reinforcement, insulation, and door edge construction.

### 1.3 DELIVERY, STORAGE, AND HANDLING

Deliver doors, frames, and accessories undamaged and with protective wrappings or packaging. Strap knock-down frames in bundles and provide temporary steel spreaders securely fastened to the bottom of each welded frame. Store doors and frames on platforms under cover in clean, dry, ventilated, and accessible locations, with 1/4 inch airspace between doors. Remove damp or wet packaging immediately and wipe affected surfaces dry. Replace damaged materials with new.

## PART 2 PRODUCTS

### 2.1 STANDARD STEEL DOORS

ANSI A250.8, except as specified otherwise. Prepare doors to receive hardware specified in Section 08710, "Door Hardware." Undercut where needed to accommodate floor finishes and thresholds. Exterior doors shall have top edge closed flush and sealed to prevent water intrusion. Doors shall be 1 3/4 inches thick, unless otherwise indicated.

#### 2.1.1 Classification - Level, Performance, Model

##### 2.1.1.1 Extra Heavy Duty Doors

ANSI A250.8, Level 3, physical performance Level A, Model 1 with core construction as required by the manufacturer for interior doors, of size(s) and design(s) indicated. Where vertical stiffener cores are required, the space between the stiffeners shall be filled with mineral board insulation. Provide Level 3 doors for all locations, except exterior locations.

##### 2.1.1.2 Maximum Duty Doors

ANSI A250.8, Level 4, physical performance Level A, Model 1 with core construction as required by the manufacturer for exterior doors, of size(s) and design(s) indicated. Where vertical stiffener cores are required, the space between the stiffeners shall be filled with mineral board insulation. Provide Level 4 doors for all exterior locations.

### 2.2 INSULATED STEEL DOOR SYSTEMS

Insulated steel doors shall have a core of polyurethane foam and an R factor of 10.0 or more (based on a k value of 0.16); face sheets, edges, and frames of galvanized steel not lighter than 23 gage, 16 gage, and 16 gage respectively; magnetic weatherstripping; nonremovable-pin hinges; thermal-break aluminum threshold; and vinyl door bottom. Doors and frames shall receive phosphate treatment, rust-inhibitive primer, and baked acrylic enamel finish. Doors shall have been tested in accordance with ANSI A250.4 and shall have met the requirements for Level C. Prepare doors to receive hardware specified in Section 08710, "Door Hardware." Doors shall be 1 3/4 inches thick.

### 2.3 ACCESSORIES

#### 2.3.1 Astragals

For pairs of exterior steel doors which will not have aluminum astragals or removable mullions, as specified in Section 08710, "Door Hardware," provide overlapping steel astragals with the doors. For interior pairs of fire rated doors, provide stainless steel astragals complying with NFPA 80 for fire rated assemblies.

### 2.3.2 Moldings

Provide moldings around glass and louvers of interior doors. Provide nonremovable moldings on corridor side of interior doors. Other moldings may be stationary or removable. Secure inside moldings to stationary moldings, or provide snap-on moldings.

## 2.4 INSULATION CORES

Insulated cores shall be of type specified, and provide an apparent U-factor of .48 in accordance with SDI 113 and shall conform to:

- a. Rigid Polyurethane Foam: ASTM C 591, Type 1 or 2, foamed-in-place or in board form, with oxygen index of not less than 22 percent when tested in accordance with ASTM D 2863; or
- b. Rigid Polystyrene Foam Board: ASTM C 578, Type I or II; or
- c. Mineral board: ASTM C 612, Type I.

## 2.5 STANDARD STEEL FRAMES

ANSI A250.8, except as otherwise specified. Form frames to sizes and shapes indicated, with welded corners or knock-down field-assembled corners.

### 2.5.1 Welded Frames

Continuously weld frame faces at corner joints. Mechanically interlock or continuously weld stops and rabbets. Grind welds smooth.

### 2.5.2 Knock-Down Frames

Design corners for simple field assembly by concealed tenons, splice plates, or interlocking joints that produce square, rigid corners and a tight fit and maintain the alignment of adjoining members. Provide locknuts for bolted connections.

### 2.5.3 Stops and Beads

Form stops and beads from 20 gage steel. Provide for glazed and other openings in standard steel frames. Secure beads to frames with oval-head, countersunk Phillips self-tapping sheet metal screws or concealed clips and fasteners. Space fasteners approximately 12 to 16 inches on centers. Miter molded shapes at corners. Butt or miter square or rectangular beads at corners.

### 2.5.4 Cased Openings

Fabricate frames for cased openings of same material, gage, and assembly as specified for metal door frames, except omit door stops and preparation for hardware.

### 2.5.5 Anchors

Provide anchors to secure the frame to adjoining construction. Provide steel anchors, zinc-coated or painted with rust-inhibitive paint, not lighter than 18 gage.

#### 2.5.5.1 Wall Anchors

Provide at least three anchors for each jamb. For frames which are more than 7.5 feet in height, provide one additional anchor for each jamb for each additional 2.5 feet or fraction thereof.

- a. Masonry: Provide anchors of corrugated or perforated steel straps or 3/16 inch diameter steel wire, adjustable or T-shaped;
- b. Stud partitions: Weld or otherwise securely fasten anchors to backs of frames. Design anchors to be fastened to closed steel studs with sheet metal screws, and to open steel studs by wiring or welding;
- c. Completed openings: Secure frames to previously placed masonry with expansion bolts in accordance with SDI 111-F; and

#### 2.5.5.2 Floor Anchors

Provide floor anchors drilled for 3/8 inch anchor bolts at bottom of each jamb member.

## 2.6 FIRE DOORS AND FRAMES

NFPA 80 and this specification. The requirements of NFPA 80 shall take precedence over details indicated or specified.

### 2.6.1 Labels

Fire doors and frames shall bear the label of Underwriters Laboratories (UL), Factory Mutual Engineering and Research (FM), or Warnock Hersey International (WHI) attesting to the rating required. Testing shall be in accordance with NFPA 252 or UL 10B. Labels shall be metal with raised letters, and shall bear the name or file number of the door and frame manufacturer. Labels shall be permanently affixed at the factory to frames and to the hinge edge of the door. Door labels shall not be painted.

### 2.6.2 Astragal on Fire Doors

On pairs of labeled fire doors, conform to NFPA 80 and UL requirements.

## 2.7 WEATHERSTRIPPING

As specified in Section 08710, "Door Hardware."

### 2.7.1 Integral Gasket

Black synthetic rubber gasket with tabs for factory fitting into factory slotted frames, or extruded neoprene foam gasket made to fit into a continuous groove formed in the frame, may be provided in lieu of head and jamb seals specified in Section 08710, "Door Hardware." Insert gasket in groove after frame is finish painted. Air leakage of weatherstripped doors

shall not exceed 1.25 cubic feet per minute of air per square foot of door area when tested in accordance with ASTM E 283.

## 2.8 HARDWARE PREPARATION

Provide minimum hardware reinforcing gages as specified in ANSI A250.6. Drill and tap doors and frames to receive finish hardware. Prepare doors and frames for hardware in accordance with the applicable requirements of ANSI A250.8 and ANSI A250.6. For additional requirements refer to DHI A115.

Drill and tap for surface-applied hardware at the project site. Build additional reinforcing for surface-applied hardware into the door at the factory. Locate hardware in accordance with the requirements of ANSI A250.8, as applicable. Punch door frames, with the exception of frames that will have weatherstripping or soundproof gasketing, to receive a minimum of two rubber or vinyl door silencers on lock side of single doors and one silencer for each leaf at heads of double doors. Set lock strikes out to provide clearance for silencers.

## 2.9 FINISHES

### 2.9.1 Factory-Primed Finish

All surfaces of doors and frames shall be thoroughly cleaned, chemically treated and factory primed with a rust inhibiting coating as specified in ANSI A250.8.

### 2.9.2 Hot-Dip Zinc-Coated and Factory-Primed Finish

Fabricate all exterior and interior hollow metal doors and frames from hot dipped zinc coated steel, alloyed type, that complies with ASTM A 924/A 924M and ASTM A 653/A 653M. The Coating weight shall meet or exceed the minimum requirements for coatings having 0.4 ounces per square foot, total both sides, i.e., A40. Repair damaged zinc-coated surfaces by the application of zinc dust paint. Thoroughly clean and chemically treat to insure maximum paint adhesion. Factory prime as specified in ANSI A250.8.

## 2.10 FABRICATION AND WORKMANSHIP

Finished doors and frames shall be strong and rigid, neat in appearance, and free from defects, waves, scratches, cuts, dents, ridges, holes, warp, and buckle. Molded members shall be clean cut, straight, and true, with joints coped or mitered, well formed, and in true alignment. Dress exposed welded and soldered joints smooth. Design door frame sections for use with the wall construction indicated. Corner joints shall be well formed and in true alignment. Conceal fastenings where practicable. Design frames in exposed masonry walls or partitions to allow sufficient space between the inside back of trim and masonry to receive calking compound.

### 2.10.1 Grouted Frames

For frames to be installed in exterior walls and to be filled with mortar or grout, fill the stops with strips of rigid insulation to keep the grout out of the stops and to facilitate installation of stop-applied head and jamb seals.

## PART 3 EXECUTION

### 3.1 INSTALLATION

### 3.1.1 Frames

Set frames in accordance with SDI 105. Plumb, align, and brace securely until permanent anchors are set. Anchor bottoms of frames with expansion bolts or powder-actuated fasteners. Build in or secure wall anchors to adjoining construction. Backfill frames with mortar. When an additive is provided in the mortar, coat inside of frames with corrosion-inhibiting bituminous material. For frames in exterior walls, ensure that stops are filled with rigid insulation before grout is placed.

### 3.1.2 Doors

Hang doors in accordance with clearances specified in ANSI A250.8. After erection and glazing, clean and adjust hardware.

### 3.1.3 Fire Doors and Frames

Install fire doors and frames, including hardware, in accordance with NFPA 80. Install fire rated doors and frames in accordance with NFPA 80.

## 3.2 PROTECTION

Protect doors and frames from damage. Repair damaged doors and frames prior to completion and acceptance of the project or replace with new, as directed. Wire brush rusted frames until rust is removed. Clean thoroughly. Apply an all-over coat of rust-inhibitive paint of the same type used for shop coat.

## 3.3 CLEANING

Upon completion, clean exposed surfaces of doors and frames thoroughly. Remove mastic smears and other unsightly marks.

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## SECTION 08120

## ALUMINUM DOORS AND FRAMES

09/99

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(1997; Rev. A) Carbon Structural Steel
ASTM B 209	(1996) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 221	(1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM E 283	(1991) Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E 331	(1996) Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

## 1.2 PERFORMANCE REQUIREMENTS

## 1.2.1 Structural

Shapes and thicknesses of framing members shall be sufficient to withstand a design wind load of not less than 40 pounds per square foot of supported area with a deflection of not more than 1/175 times the length of the member and a safety factor of not less than 1.65. Provide glazing beads, moldings, and trim of not less than 0.050 inch nominal thickness.

## 1.2.2 Air Infiltration

When tested in accordance with ASTM E 283, air infiltration shall not exceed 0.06 cubic feet per minute per square foot of fixed area at a test pressure of 6.24 pounds per square foot (50 mile per hour wind).

## 1.2.3 Water Penetration

When tested in accordance with ASTM E 331, there shall be no water penetration at a pressure of 8 pounds per square foot of fixed area.

## 1.3 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal

Procedures."

SD-02 Shop Drawings

Doors and frames; G-DO

Show elevations of each door type, size of doors and frames, metal gages, details of door and frame construction, methods of anchorage, glazing details, weatherstripping, provisions for and location of hardware, and details of installation.

SD-04 Samples

Doors and frames; G-DO

Submit a minimum of 3 samples of each proposed color.

SD-08 Manufacturer's Instructions

Doors and frames; G-AO

Submit detail specifications and instructions for installation, adjustments, cleaning, and maintenance.

1.4 DELIVERY, STORAGE, AND HANDLING

Inspect materials delivered to the site for damage. Unload and store with minimum handling. Provide storage space in dry location with adequate ventilation, free from dust or water, and easily accessible for inspection and handling. Stack materials on nonabsorptive strips or wood platforms. Do not cover doors and frames with tarps, polyethylene film, or similar coverings. Protect finished surfaces during shipping and handling using manufacturer's standard method, except that no coatings or lacquers shall be applied to surfaces to which calking and glazing compounds must adhere.

PART 2 PRODUCTS

2.1 DOORS AND FRAMES

Swing-type aluminum doors and frames of size, design, and location indicated. Provide doors complete with frames, framing members subframes, transoms, adjoining sidelights, trim, and accessories.

2.2 MATERIALS

2.2.1 Anchors

Stainless steel or steel with hot-dipped galvanized finish.

2.2.2 Weatherstripping

Continuous wool pile, silicone treated, or type recommended by door manufacturer.

2.2.3 Aluminum Alloy for Doors and Frames

ASTM B 221, Alloy 6063-T5 for extrusions. ASTM B 209, alloy and temper best suited for aluminum sheets and strips.

#### 2.2.4 Fasteners

Hard aluminum or stainless steel.

#### 2.2.5 Structural Steel

ASTM A 36/A 36M.

#### 2.2.6 Aluminum Paint

Type as recommended by aluminum door manufacturer.

### 2.3 FABRICATION

#### 2.3.1 Aluminum Frames

Extruded aluminum shapes with contours approximately as indicated. Provide removable glass stops and glazing beads for frames accommodating fixed glass. Use countersunk stainless steel Phillips screws for exposed fastenings, and space not more than 12 inches o.c. Mill joints in frame members to a hairline fit, reinforce, and secure mechanically.

#### 2.3.2 Aluminum Doors

Of type, size, and design indicated and not less than 1 3/4 inches thick. Minimum wall thickness, 0.125 inch, except beads and trim, 0.050 inch. Door sizes shown are nominal and shall include standard clearances as follows: 0.093 inch at hinge and lock stiles, 0.125 inch between meeting stiles, 0.125 inch at top rails, 0.187 inch between bottom and threshold, and 0.687 inch between bottom and floor. Bevel single-acting doors 0.063 or 0.125 inch at lock, hinge, and meeting stile edges.

##### 2.3.2.1 Full Glazed Stile and Rail Doors

Doors shall have medium stiles and rails as indicated. Fabricate from extruded aluminum hollow seamless tubes or from a combination of open-shaped members interlocked or welded together. Fasten top and bottom rail together by means of welding or by 3/8 or 1/2 inch diameter cadmium-plated tensioned steel tie rods. Provide an adjustable mechanism of jack screws or other methods in the top rail to allow for minor clearance adjustments after installation.

##### 2.3.3 Welding and Fastening

Where possible, locate welds on unexposed surfaces. Dress welds on exposed surfaces smoothly. Select welding rods, filler wire, and flux to produce a uniform texture and color in finished work. Remove flux and spatter from surfaces immediately after welding. Exposed screws or bolts will be permitted only in inconspicuous locations, and shall have countersunk heads. Weld concealed reinforcements for hardware in place.

##### 2.3.4 Weatherstripping

Provide on stiles and rails of exterior doors. Fit into slots which are integral with doors or frames. Weatherstripping shall be replaceable without special tools, and adjustable at meeting rails of pairs of doors. Installation shall allow doors to swing freely and close positively. Air leakage of a single leaf weatherstripped door shall not exceed 0.5 cubic feet per minute of air per square foot of door area when tested in

accordance with ASTM E 283.

#### 2.3.5 Anchors

On the backs of subframes, provide anchors of the sizes and shapes indicated for securing subframes to adjacent construction. Anchor transom bars at ends and mullions at head and sill. Reinforce and anchor freestanding door frames to floor construction as indicated on approved shop drawings and in accordance with manufacturer's recommendation. Place anchors near top and bottom of each jamb and at intermediate points not more than 25 inches apart.

#### 2.3.6 Provisions for Hardware

Hardware is specified in Section 08710, "Door Hardware." Deliver hardware templates and hardware (except field-applied hardware) to the door manufacturer for use in fabrication of aluminum doors and frames. Cut, reinforce, drill, and tap doors and frames at the factory to receive template hardware. Provide doors to receive surface-applied hardware, except push plates, kick plates, and mop plates, with reinforcing only; drill and tap in the field. Provide hardware reinforcements of stainless steel or steel with hot-dipped galvanized finish, and secure with stainless steel screws.

#### 2.3.7 Provisions for Glazing

Provide extruded aluminum snap-in glazing beads on interior side of doors. Provide extruded aluminum, theft-proof, snap-in glazing beads or fixed glazing beads on exterior or security side of doors. Glazing beads shall have vinyl insert glazing gaskets. Design glazing beads to receive glass of thickness indicated or specified. Glazing is specified in Section 08810A, GLASS AND GLAZING.

#### 2.3.8 Finishes

Provide exposed aluminum surfaces with factory finish of organic coating.

##### 2.3.8.1 Organic Coating

Clean and prime exposed aluminum surfaces. Exposed surfaces of the aluminum windows shall be finished with a two-coat fluoropolymer coating system containing at least 70 percent by weight polyvinylidene fluoride, PVF2 resin, factory-applied, oven-baked, conforming to AAMA 605, with a primer coat of 0.02 to 0.30 mils and a color coat of minimum 1.0 mil, total dry film thickness of 1.20 to 1.3 mils. Paint finish requirements shall match finish requirements as stated in SECTION 8520, ALUMINUM AND ENVIRONMENTAL CONTROL ALUMINUM WINDOWS. The finish color shall be as indicated in SECTION 09915, COLOR SCHEDULE.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Plumb, square, level, and align frames and framing members to receive doors, transoms, and adjoining sidelights. Anchor frames to adjacent construction as indicated and in accordance with manufacturer's printed instructions. Anchor bottom of each frame to rough floor construction with 3/32 inch thick stainless steel angle clips secured to back of each jamb and to floor construction; use stainless steel bolts and expansion rivets for fastening

clip anchors. Seal metal-to-metal joints between framing members as specified in Section 07900A, JOINT SEALING. Hang doors to produce clearances specified in paragraph entitled "Aluminum Doors," of this section. After erection and glazing, adjust doors and hardware to operate properly.

### 3.2 PROTECTION FROM DISSIMILAR MATERIALS

#### 3.2.1 Dissimilar Metals

Where aluminum surfaces come in contact with metals other than stainless steel, zinc, or small areas of white bronze, protect from direct contact by one or a combination of the following methods:

- a. Paint the dissimilar metal with one coat of heavy-bodied bituminous paint.
- b. Apply a good quality elastomeric sealant between the aluminum and the dissimilar metal.
- c. Paint the dissimilar metal with one coat of primer and one coat of aluminum paint.
- d. Use a nonabsorptive tape or gasket in permanently dry locations.

#### 3.2.2 Drainage from Dissimilar Metals

In locations where drainage from dissimilar metals has direct contact with aluminum, provide protective paint, to prevent aluminum discoloration.

#### 3.2.3 Masonry and Concrete

Provide aluminum surfaces in contact with mortar, concrete, or other masonry materials with one coat of heavy-bodied bituminous paint.

#### 3.2.4 Wood or Other Absorptive Materials

Provide aluminum surfaces in contact with absorptive materials subject to frequent moisture, and aluminum surfaces in contact with treated wood, with two coats of aluminum paint or one coat of heavy-bodied bituminous paint. In lieu of painting the aluminum, the Contractor shall have the option of painting the wood or other absorptive surface with two coats of aluminum paint and sealing the joints with elastomeric sealant.

### 3.3 CLEANING

Upon completion of installation, clean door and frame surfaces in accordance with door manufacturer's recommended procedure. Do not use abrasive, caustic, or acid cleaning agents.

### 3.4 PROTECTION

Protect doors and frames from damage and from contamination by other materials such as cement mortar. Prior to completion and acceptance of the work, restore damaged doors and frames to original condition, or replace with new ones.

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SECTION 08210

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## SECTION 08210

WOOD DOORS  
09/99

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 152 (1981; Rev. A) Fire Tests of Door Assemblies

## ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI Qual Stds (1997) Architectural Woodwork Quality Standards and Quality Certification Program

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (1995) Fire Doors and Fire Windows

NFPA 252 (1995) Fire Tests of Door Assemblies

## WINDOW AND DOOR MANUFACTURERS ASSOCIATION (WDMA)

NWWDA I.S. 1-A (1993) Architectural Wood Flush Doors

NWWDA I.S. 6 (1991) Wood Stile and Rail Doors

NWWDA TM-5 (1990) Split Resistance Test

NWWDA TM-7 (1990) Cycle - Slam Test

NWWDA TM-8 (1990) Hinge Loading Resistance Test

## UNDERWRITERS LABORATORIES (UL)

UL 10B (1997) Fire Tests of Door Assemblies

## 1.2 SUBMITTALS

Submit the following in accordance with Section 01330, SUBMITTAL PROCEDURES.

## SD-02 Shop Drawings

Doors; G-DO

Submit drawings or catalog data showing each type of door unit. Drawings and data shall indicate door type and construction, sizes, thickness, methods of assembly, and glazing,.

SD-03 Product Data

Doors; G-DO

Accessories; G-DO

Sample warranty; G-DO

Fire resistance rating; G-DO

SD-04 Samples

Doors; G-DO

Prior to the delivery of wood doors, submit a sample section of each type of door which shows the stile, rail, veneer, finish, and core construction.

Door finish colors; G-DO

Submit a minimum of three color selection samples.

SD-06 Test Reports

Split resistance

Cycle-slam

Hinge loading resistance

Submit split resistance test report for doors tested in accordance with NWWDA TM-5, cycle-slam test report for doors tested in accordance with NWWDA TM-7, and hinge loading resistance test report for doors tested in accordance with NWWDA TM-8.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver doors to the site in an undamaged condition and protect against damage and dampness. Stack doors flat under cover. Support on blocking, a minimum of 4 inches thick, located at each end and at the midpoint of the door. Store doors in a well-ventilated building so that they will not be exposed to excessive moisture, heat, dryness, direct sunlight, or extreme changes of temperature and humidity. Do not store in a building under construction until concrete and masonry work are dry. Replace defective or damaged doors with new ones.

1.4 WARRANTY

Warranty shall warrant doors free of defects as set forth in the door manufacturer's standard door warranty.

PART 2 PRODUCTS

2.1 DOORS

Provide doors of the types, sizes, and designs indicated.

2.1.1 Stile and Rail Doors

Premium grade Ponderosa Pine doors or premium or select stile and rail doors conforming to NWWDA I.S. 6. Flat panels shall have a minimum finished panel thickness of 1/2 inch.

#### 2.1.2 Flush Doors

Flush doors shall conform to NWWDA I.S. 1-A. Hollow core doors shall have lock blocks and one inch minimum thickness hinge stile. Stile edge bands of doors to receive natural finish shall be hardwood, compatible with face veneer. No visible finger joints will be accepted in stile edge bands. When used, locate finger-joints under hardware.

##### 2.1.2.1 Interior Flush Doors

Provide staved lumber core, Type II flush doors conforming to NWWDA I.S. 1-A with faces of premium grade red oak. Hardwood veneers shall be rotary cut.

#### 2.1.3 Composite-Type Fire Doors

Doors specified or indicated to have a fire resistance rating shall conform to the requirements of UL 10B, ASTM E 152, or NFPA 252 for the class of door indicated. Affix a permanent metal label with raised or incised markings indicating testing agency's name and approved hourly fire rating to hinge edge of each door.

### 2.2 ACCESSORIES

#### 2.2.1 Door Light Openings

Provide glazed openings with the manufacturer's standard wood moldings shall be of the same specie and color as the face veneers. Moldings shall be lip type. Provide glazed openings in fire-rated doors with fire rated frames. Glazing is specified in Section 08810A, GLASS AND GLAZING.

#### 2.2.2 Additional Hardware Reinforcement

Provide fire rated doors with hardware reinforcement blocking. Size of lock blocks shall be as required to secure the hardware specified. Reinforcement blocking shall be in compliance with the manufacturer's labeling requirements and shall not be mineral material similar to the core.

### 2.3 FABRICATION

#### 2.3.1 Marking

Each door shall bear a stamp, brand, or other identifying mark indicating quality and construction of the door.

#### 2.3.2 Quality and Construction

Identify the standard on which the construction of the door was based and identify doors having a Type I glue bond.

#### 2.3.3 Adhesives and Bonds

NWWDA I.S. 1-A. Use Type II bond for interior doors. Adhesive for doors to receive a natural finish shall be nonstaining.

### 2.3.4 Prefitting

At the Contractor's option, doors may be provided factory pre-fit. Doors shall be sized and machined at the factory by the door manufacturer in accordance with the standards under which they are produced. The work shall include sizing, bevelling edges, mortising, and drilling for hardware and providing necessary beaded openings for glass. Provide the door manufacturer with the necessary hardware samples, and frame and hardware schedules as required to coordinate the work.

### 2.3.5 Finishes

#### 2.3.5.1 Field Painting

Factory prime or seal doors, and field paint as specified in Section 09900, PAINTS AND COATINGS. Contractor has the option of providing factory finished doors or field finished doors. Whether doors are factory or field finished, paint coating finishing thickness requirements shall be in accordance with SECTION 09900.

#### 2.3.5.2 Factory Finish

Provide doors finished at the factory by the door manufacturer as follows: AWI Qual Stds Section 1500, specification for System No. 4 Conversion varnish alkyd urea or System No. 5 Vinyl catalyzed. The coating shall be AWI Qual Stds premium, medium rubbed sheen, open grain effect. Use stain when required to produce the finish specified for color. Seal edges, cutouts, trim, and wood accessories, and apply two coats of finish compatible with the door face finish. Touch-up finishes that are scratched or marred, or where exposed fastener holes are filled, in accordance with the door manufacturer's instructions. Match color and sheen of factory finish using materials compatible for field application.

#### 2.3.5.3 Color

Provide door finish colors as indicated.

#### 2.3.6 Water-Resistant Sealer

Provide a water-resistant sealer compatible with the specified finish as approved and as recommended by the door manufacturer.

### 2.4 SOURCE QUALITY CONTROL

Stiles of fire rated doors utilizing standard mortise leaf hinges shall meet the following performance criteria:

- a. Split resistance: Average of ten test samples shall be not less than 500 pounds load when tested in accordance with NWWDA TM-5.
- b. Cycle-slam: 200,000 cycles with no loose hinge screws or other visible signs of failure when tested in accordance with the requirements of NWWDA TM-7.
- c. Hinge loading resistance: Average of ten test samples shall be not less than 700 pounds load when tested for direct screw withdrawal in accordance with NWWDA TM-8 using a No. 12, 1 1/4 inch long, steel, fully threaded wood screw. Drill 5/32 inch pilot

hole, use 1 1/2 inch opening around screw for bearing surface, and engage screw full, except for last 1/8 inch. Do not use a steel plate to reinforce screw area.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Before installation, seal top and bottom edges of doors with the approved water-resistant sealer. Seal cuts made on the job immediately after cutting using approved water-resistant sealer. Fit, trim, and hang doors with a 1/16 inch minimum, 1/8 inch maximum clearance at sides and top, and a 3/16 inch minimum, 1/4 inch maximum clearance over thresholds. Provide 3/8 inch minimum, 7/16 inch maximum clearance at bottom where no threshold occurs. Bevel edges of doors at the rate of 1/8 inch in 2 inches. Door warp shall not exceed 1/4 inch when measured in accordance with NWWDA I.S. 1-A.

##### 3.1.1 Fire Doors

Install fire doors in accordance with NFPA 80. Do not paint over labels.

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SECTION 08330A

OVERHEAD ROLLING DOORS (ORD)

09/02

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## SECTION 08330A

OVERHEAD ROLLING DOORS (ORD)  
09/02

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM A 653/A 653M (2001a) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip process

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2 (2002) Industrial Controls and Systems Controllers, Contactors, and Overload Relays Rated Not More Than 2,000 Volts AC or 750 Volts DC

NEMA ICS 6 (1993; R 2001) Industrial Control and Systems Enclosures

NEMA MG 1 (1998) Motors and Generators

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

## 1.2 DESCRIPTION

Overhead rolling doors shall be spring counterbalanced, rolling type, with interlocking slats, complete with guides, fastenings, hood, brackets, and operating mechanisms, and shall be designed for use on openings as indicated. Each door shall be provided with a permanent label showing the manufacturer's name and address and the model/serial number of the door.

## 1.2.1 Wind Load Requirements

Doors and components shall be designed to withstand the minimum design wind load of 40 psf. Doors shall be constructed to sustain a superimposed load, both inward and outward, equal to 1-1/2 times the minimum design wind load. Recovery shall be at least 3/4 of the maximum deflection within 24 hours after the test load is removed. Sound engineering principles may be used to interpolate or extrapolate test results to door sizes not specifically tested.

## 1.2.2 Operational Cycle Life

All portions of the door and door operating mechanism that are subject to movement, wear, or stress fatigue shall be designed to operate through a minimum number of 10 cycles per day. One complete cycle of door operation is defined as when the door is in the closed position, moves to the full open position, and returns to the closed position.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

Approved Detail Drawings; G-DO  
Installation; G-AO

Drawings showing the location of each door including schedules. Drawings shall include elevations of each door type, details and method of anchorage, details of construction, location and installation of hardware, shape and thickness of materials, details of joints and connections, and details of guides, power operators, controls, and other fittings.

#### SD-03 Product Data

Overhead Rolling Doors; G-DO  
Manufacturer's catalog data.  
Manufacturer's preprinted installation instructions.

#### SD-04 Samples

Overhead Rolling Doors; G-DO  
Manufacturer's standard color samples of factory applied finishes.

#### SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G-AO  
Six copies of the system operation manual and system maintenance and repair manual for each type of door and control system.

### 1.4 DELIVERY AND STORAGE

Doors shall be delivered to the jobsite wrapped in a protective covering with the brands and names clearly marked thereon. Doors shall be stored in a dry location that is adequately ventilated and free from dirt and dust, water, and other contaminants, and in a manner that permits easy access for inspection and handling.

### 1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend

beyond a 1-year period shall be provided.

## 1.6 OPERATION AND MAINTENANCE MANUALS

Operating instructions outlining the step-by-step procedures required for motorized door operation for the overhead rolling door unit shall be provided. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, troubleshooting guides, and simplified diagrams for the equipment as installed shall be provided. A complete list of parts and supplies, source of supply, and a list of the high mortality maintenance parts shall be provided.

## PART 2 PRODUCTS

### 2.1 OVERHEAD ROLLING DOORS

Doors shall be surface-mounted type with guides at jambs set back a sufficient distance to clear the opening.

#### 2.1.1 Curtains

The curtains shall roll up on a barrel supported at the head of opening on brackets, and shall be balanced by helical torsion springs. Steel slats shall be minimum bare metal thickness of 0.0281 inches. Slats shall be of the minimum bare metal decimal thickness required for the width indicated and the wind pressure specified above.

##### 2.1.1.1 Non-Insulated Curtains

Curtains shall be formed of interlocking slats of shapes standard with the manufacturer. Slats for doors shall be flat type.

#### 2.1.2 Endlocks and Windlocks

The ends of each alternate slat for interior doors shall have steel endlocks of manufacturer's stock design. In addition to endlocks, non-rated doors shall have the manufacturer's standard windlocks as required to withstand the wind load. Windlocks shall prevent the curtain from leaving guides because of deflection from specified wind pressure.

#### 2.1.3 Bottom Bar

The curtain shall have a standard bottom bar consisting of two hot-dip galvanized steel angles for steel doors. A sensing edge shall be attached to the bottom bar of doors that are electric-power operated.

#### 2.1.4 Guides

Guides shall be steel structural shapes or formed steel shapes, of a size and depth to provide proper clearance for operation and resistance under the design windload. Guides shall be attached to adjoining construction with fasteners recommended by the manufacturer. Spacing of fasteners shall be as required to meet the minimum design windload. Doors and guides in hazardous areas shall have static grounding.

#### 2.1.5 Barrel

The barrel shall be steel pipe or commercial welded steel tubing of proper diameter for the size of curtain. Deflection shall not exceed 0.03 inch per foot of span. Ends of the barrel shall be closed with metal plugs, machined to fit the pipe. Aluminum plugs are acceptable on non-fire door barrels.

#### 2.1.6 Springs

Oil tempered helical steel counter-balance torsion springs shall be installed within the barrel and shall be capable of producing sufficient torque to assure easy operation of the door curtain. Access shall be provided for spring tension adjustment from outside of the bracket without removing the hood.

#### 2.1.7 Brackets

Brackets shall be of steel plates to close the ends of the roller-shaft housing, and to provide mounting surfaces for the hood. An operation bracket hub and shaft plugs shall have sealed prelubricated ball bearings.

#### 2.1.8 Hoods

Hoods shall be steel with minimum bare metal thickness of 0.0219 inches formed to fit contour of the end brackets, and shall be reinforced with steel rods, rolled beads, or flanges at top and bottom edges. Multiple segment and single piece hoods shall be provided with support brackets of the manufacturer's standard design as required for adequate support.

#### 2.1.9 Weatherstripping

A compressible and replaceable weather seal shall be attached to the bottom bar. Weatherstripping shall be easily replaced without special tools.

#### 2.1.10 Operation

Doors shall be operated by means of electric power with auxiliary chain hoist. Equipment shall be designed and manufactured for usage in non-hazardous areas.

##### 2.1.10.1 Electric Power Operator With Auxiliary Chain Hoist Operation

Electric power operators shall be heavy-duty industrial type. The unit shall operate the door through the operational cycle life specified. The electric power operator shall be complete with electric motor, auxiliary operation, necessary means of reduction for medium-duty doors, brake, mounting brackets, push button controls, limit switches, magnetic reversing starter, and all other accessories necessary to operate components specified in other paragraphs of this section. The operator shall be so designed that the motor may be removed without disturbing the limit-switches settings and without affecting the emergency chain operator.

Doors shall be provided with an auxiliary operator for immediate emergency manual operation of the door in case of electrical failure. Auxiliary operation shall be by means of galvanized endless chain extending to within 3 feet of the floor. The emergency manual operating mechanism shall be so arranged that it may be operated from the floor without affecting the settings of the limit switches. A mechanical device shall be included that will disconnect the motor from the drive operating mechanism when the

auxiliary operator is used. Where control voltages differ from motor voltage, a control voltage transformer shall be provided in and as part of the electric power operator system. Control voltage shall not exceed 120 volts.

a. Motors: Drive motors shall conform to NEMA MG 1, shall be high-starting torque, reversible type, and shall be of sufficient horsepower and torque output to move the door in either direction from any position at a speed range of 6 to 8 inches per second without exceeding the rated capacity. Motors shall be suitable for operation on 480 volts, 60 hertz, 3-phase current and shall be suitable for across-the-line starting. Motors shall be designed to operate at full capacity over a supply voltage variation of plus or minus 10 percent of the motor voltage rating. Motors shall be provided with overload protection.

b. Controls: Control equipment shall conform to NEMA ICS 2. Enclosures shall conform to NEMA ICS 6, Type 12 (industrial use), in accordance with NFPA 70. Exterior control stations shall be weatherproof key-operated type with corrosion-resistant cast-metal cover. Each control station shall be of the three position button type, marked "OPEN," "CLOSE," and "STOP." The "OPEN" and "STOP" controls shall be of the momentary contact type with seal-in contact. The "CLOSE" control shall be of the momentary contact type. When the door is in motion and the "STOP" control is pressed, the door shall stop instantly and remain in the stop position; from the stop position, the door shall be operable in either direction by the "OPEN" or "CLOSE" controls. Controls shall be of the full-guarded type to prevent accidental operation. Readily adjustable limit switches shall be provided to automatically stop the doors at their fully open and closed positions.

c. Sensing Edge Device: The bottom edge of electric power operated doors shall have an electric sensing edge for non-hazardous areas that will reverse the door movement upon contact with an obstruction and cause the door to return to its full open position. The sensing edge shall not substitute for a limit switch. Exterior doors shall be provided with a combination compressible weather seal and sensing edge.

d. Electrical Work: Conduit and wiring necessary for proper operation shall be provided under Section 16415A ELECTRICAL WORK, INTERIOR. Flexible connections between doors and fixed supports shall be made with flexible type SJO cable. The cable shall have a spring-loaded automatic take up reel or a coil cord equivalent device.

#### 2.1.11 Locking

Door locking devices shall not be required.

#### 2.1.12 Finish

Steel slats and hoods shall be hot-dip galvanized G90 in accordance with ASTM A 653/A 653M, and shall be treated for paint adhesion and shall receive a factory baked-on prime coat for field finishing. Surfaces other than slats, hood, and faying surfaces shall be cleaned and treated to assure maximum paint adherence and shall be given a factory dip or spray coat of rust inhibitive metallic oxide or synthetic resin primer. Color shall be in accordance with Section 09915 COLOR SCHEDULE.

### PART 3 EXECUTION

### 3.1 INSTALLATION

Doors shall be installed in accordance with approved detail drawings and manufacturer's instructions. Anchors and inserts for guides, brackets, motors, switches, hardware, and other accessories shall be accurately located. Upon completion, doors shall be free from warp, twist, or distortion. Doors shall be lubricated, properly adjusted, and demonstrated to operate freely.

### 3.2 FIELD PAINTED FINISH

Steel doors and frames shall be field painted in accordance with Section 09900 PAINTING, GENERAL. Finish shall be free of scratches or other blemishes. Color shall be in accordance with Section 09915 COLOR SCHEDULE.

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**09/98**

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## SECTION 08331A

METAL ROLLING COUNTER DOORS  
09/98

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 653/A 653M (1999a) Steel Sheet, Zinc-Coated  
(Galvanized) or Zinc-Iron Alloy-Coated  
(Galvannealed) by the Hot-Dip Process

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (1999) Fire Doors and Fire Windows

## 1.2 GENERAL

Rolling counter doors shall be of the type, size, and design indicated on the drawings, and shall be the standard product of a manufacturer regularly engaged in the production of rolling counter doors. Each door shall be provided with a permanent label showing the manufacturer's name and address and the model number of the door.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

## Approved Detail Drawings; G-DO

Drawings showing elevations of each door type, details of anchorage, details of construction, location and description of hardware, shape and thickness of materials, details of joints and connections, and details of guides and fittings. A schedule showing the location of each counter door shall be included with the drawings.

## SD-03 Product Data

## Rolling Counter Doors; G-DO

Manufacturer's descriptive data and catalog cuts.

Installation; G-AO  
Cleaning; G-AO

Manufacturer's preprinted installation and cleaning instructions.

#### SD-10 Operation and Maintenance Data

##### Operation;

Six complete copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, troubleshooting guides, and simplified diagrams for the equipment as installed. Spare parts data for each different item of material and equipment specified shall be supplied not later than 3 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of the parts recommended by the manufacturer to be replaced after 1 year of service.

#### 1.4 DELIVERY AND STORAGE

Rolling counter doors shall be delivered to the jobsite wrapped in a protective covering with the brands and names clearly marked thereon. Rolling counter doors shall be stored in accordance with the manufacturer's instructions in a dry location that is adequately ventilated and free from dust, water, or other contaminants, and in a manner that permits easy access for inspecting and handling. Doors shall be handled carefully to prevent damage. Damaged items that cannot be restored to like-new condition shall be replaced.

#### 1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

### PART 2 PRODUCTS

#### 2.1 BASIC COMPONENTS

##### 2.1.1 Curtain

The curtain shall be fabricated of 22 gauge galvanized steel slats conforming to ASTM A 653/A 653M, Coating Designation G90 as specified. Thickness of slat material shall be as required by width of opening or as required by specified fire-rating. Slats shall be approximately 1-1/4 to 1-1/2 inch wide with a depth of crown of 1/2 inch. Alternate slats shall be fitted with end locks to maintain curtain alignment. Bottom of curtain shall be provided with angle or tubular bar reinforcement matching the curtain, and fitted with a resilient bottom seal.

##### 2.1.2 Jamb Guides

Guides shall be of 13 gauge minimum thickness galvanized steel angles conforming to ASTM A 653/A 653M, Coating Designation. G90.

##### 2.1.3 Counterbalance Shaft Assembly

The curtain shall be coiled around a steel tube of sufficient thickness and diameter to prevent deflection exceeding 0.03 inch per foot. The barrel shall contain oil tempered helical steel torsion springs capable of sufficient torque to counterbalance the weight of the curtain. Springs shall be calculated to provide a minimum of 7,500 operating cycles (one complete cycle of door operation will begin with the door in the closed position, move to the full open position and return to the closed position).

#### 2.1.4 Brackets

Brackets shall be a minimum 12 gauge thickness steel if flat plate, or 16 gauge thickness if there are a minimum of 3 returns of 3/4 inch width.

#### 2.1.5 Hood

The hood shall be of 24 gauge galvanized steel conforming to ASTM A 653/A 653M, Coating Designation G90.

#### 2.1.6 Sill and Locks

The curtain is not required to have a keyed lock since it will be used only when activated by the building fire alarm system. Door latching requirements shall comply with standard UL rolling counter door requirements. Standard manufacturer's UL rated, galvanized door sill shall be provided and finished to match door assembly. Sill countertop shall only project the minimum distance required to meet UL door closure requirements.

### 2.2 FIRE-RATED ROLLING COUNTER DOOR

Fire-rated rolling counter doors shall be UL 1-1/2 hr. rated and shall conform to the requirements specified and to NFPA 80 for the class indicated. Doors shall bear the labels of a recognized testing agency indicating the applicable fire resistance rating. The construction details necessary for labeled rolling counter doors shall take precedence over details indicated or specified herein. Door curtains, guides, sill and hood shall be galvanized steel. Fire-rated rolling counter doors shall be complete with hardware, accessories, and automatic closing device.

### 2.3 INTEGRAL FRAME ROLLING COUNTER DOOR (RATED)

Integral frame rolling counter door shall be galvanized steel, UL 1-1/2 hr. as shown. Fire-rated doors shall conform to the requirements of NFPA 80 for the Class indicated and shall bear the labels of a recognized testing agency indicating the applicable fire resistance rating. Jambs shall be formed to create guides for the curtain. Head and jambs shall be 16 gauge thickness.

### 2.4 OPERATION

#### 2.4.1 Manual Operation

The curtain shall be operated by means of manual push-up with lift handles or continuous full width lift bar.

### 2.5 AUTOMATIC CLOSING DEVICE

Fire-rated counter doors shall be equipped with an automatic closing device which shall operate upon activation of the building's fire alarm system.

Fire and smoke doors shall be easily reset by the facility user after they have been released by the detection system. Resetting the door shall not require the use of special tools.

## 2.6 FINISH

Exposed parts of the counter door, including the curtain, bottom rail, guides, and hood shall be of uniform finish and appearance. Steel galvanized coating shall have a prime paint coat. All other steel parts shall be given a shop coat of primer paint standard with the manufacturer.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Doors shall be installed in accordance with approved detail drawings and manufacturer's instructions. Anchors and inserts for guides, brackets, hardware, and other accessories shall be accurately located. Upon completion, doors shall be free from warp, twist, or distortion. Doors shall be lubricated, properly adjusted, and demonstrated to operate freely. Fire-door installation shall be in conformance with NFPA 80 for the class indicated and the manufacturer's instructions.

### 3.2 FIELD FINISHING

Doors, hood and guides shall receive field finishing and be factory primed.

Final paint coat shall be field applied in accordance with Section 09900 PAINTING, GENERAL. Color shall be in accordance with Section 09915 COLOR SCHEDULE.

### 3.3 CLEANING

Aluminum and stainless steel doors shall be cleaned in accordance with manufacturer's approved instructions.

### 3.4 TESTS

The fire doors shall be drop tested in accordance with NFPA 80 to show proper operation and full automatic closure and shall be reset in accordance with the manufacturer's instructions. A written record of initial test shall be provided to the Contracting Officer.

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SECTIONAL OVERHEAD DOORS

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## SECTION 08361

SECTIONAL OVERHEAD DOORS  
08/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(1997; Rev. A) Carbon Structural Steel
ASTM A 123/A 123M	(1997; Rev. A) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 227/A 227M	(1993) Steel Wire, Cold-Drawn for Mechanical Springs
ASTM A 229/A 229M	(1993) Steel Wire, Oil-Tempered for Mechanical Springs
ASTM A 653/A 653M	(1998) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM C 236	(1989; R 1993) Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box
ASTM E 330	(1997) Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

## DOOR AND ACCESS SYSTEMS MANUFACTURERS ASSOCIATION (DASMA)

NAGDM 102	(1988) Sectional Overhead Type Doors
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## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1	(1993) Industrial Control and Systems
NEMA ICS 2	(1993) Industrial Control and Systems Controllers, Contactors and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC
NEMA ICS 6	(1993) Industrial Control and Systems Enclosures
NEMA MG 1	(1993; Rev. 1-4) Motors and Generators
NEMA ST 20	(1992) Dry-Type Transformers for General

## Applications

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70

(2002) National Electrical Code

## 1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

## SD-02 Shop Drawings

Doors; G-DO

Show types, sizes, locations, metal gages including minimum metal decimal thickness, hardware provisions, installation details, and other details of construction. For electrically-operated doors, include supporting brackets for motors, location, type, and ratings of motors, switches, and safety devices.

## SD-03 Product Data

Doors; G-DO

Electric operators; G-DO

For electrically motor-operated doors, submit manufacturer's wiring diagrams for motor and controls.

## SD-08 Manufacturer's Instructions

Doors

## SD-10 Operation and Maintenance Data

Doors; G-AO

Submit Data Package 2 in accordance with Section 01781, "Operation and Maintenance Data."

## 1.3 DELIVERY, STORAGE, AND HANDLING

Protect doors and accessories from damage during delivery, storage, and handling. Clearly mark manufacturer's brand name. Store doors in dry locations with adequate ventilation, free from dust and water. Storage shall permit easy access for inspection and handling. Remove damaged items and provide new.

## PART 2 PRODUCTS

## 2.1 MATERIALS

## 2.1.1 Hard-Drawn Springwire

ASTM A 227/A 227M.

## 2.1.2 Oil-Tempered Springwire

ASTM A 229/A 229M.

### 2.1.3 Steel Sheet

ASTM A 653/A 653M.

### 2.1.4 Steel Shapes

ASTM A 36/A 36M.

### 2.1.5 Glass

Fully tempered, clear, insulated glazing unit, 3/4 to 1-inch thick, clear, insulated, acrylic glass panel.

## 2.2 DOORS

NAGDM 102. Commercial doors. Metal doors shall be horizontal sections hinged together which operate in a system of tracks to completely close the door opening in the closed position and make the full width and height of the door opening available for use in the open position. Provide a permanent label on the door indicating the name and address of the manufacturer. Doors shall be of the standard lift type designed to slide up and back into a horizontal overhead position and requiring a maximum of 12 inches of headroom for 3 inchtracks. Doors shall be operated by electric power with auxiliary hand chain operation.

## 2.3 DESIGN REQUIREMENTS

NAGDM 102, except that design wind load shall be 40 pounds per square foot.

Doors shall remain operable and undamaged after conclusion of tests conducted in accordance with ASTM E 330 using the design wind load.

## 2.4 FABRICATION

### 2.4.1 Steel Overhead Doors

Form door sections of hot-dipped galvanized steel not lighter than 16 gage with flush surface without ribs or grooves. Sections shall be not less than 2 inches in thickness. Meeting rails shall have interlocking joints to ensure a weathertight closure and alignment for full width of the door. Sections shall be of the height indicated or the manufacturer's standard, except the height of an intermediate section shall not exceed 24 inches. Bottom sections may be varied to suit door height, but shall not exceed 30 inches in height. Provide two glass panels per door as indicated on the drawings. Contractor has the option of either providing the insulated glass panel or the acrylic glass panel. The glass panels selected by the Contractor shall be used on all of the doors. Glass panel sizes indicated on the drawings are approximate sizes. Contractor has the option of submitting manufacturer's standard glass panel sizes larger than the sizes shown on the drawings. Install panels using rubber gaskets as standard with the door manufacturer.

#### 2.4.1.1 Insulated Sections

Insulate door sections with fibrous glass or plastic foam to provide an "R-Value" greater than 15 when tested in accordance with ASTM C 236. Cover interior of door sections with steel sheets of not lighter than 24 gage to completely enclose the insulating material.

#### 2.4.2 Tracks

Provide galvanized steel tracks not lighter than 12 gage for 3 inch tracks.

Provide vertical tracks with continuous steel angle not lighter than 13 gage for installation to walls. Incline vertical track through use of adjustable brackets to obtain a weathertight closure at jambs. Reinforce horizontal track with galvanized steel angle; support from track ceiling construction with galvanized steel angle and cross bracing to provide a rigid installation.

#### 2.4.3 Hardware

Provide hinges, brackets, rollers, locking devices, and other hardware required for complete installation. Roller brackets and hinges shall be 14 gage galvanized steel. Rollers shall have ball bearings and case-hardened races. Provide reinforcing on doors where roller hinges are connected. All interior and exterior doors shall not require key, padlock and/or throw bolt locking devices. Door in closed position shall be secure and shall prevent unauthorized entry.

#### 2.4.4 Counterbalancing

Counterbalance doors with an oil-tempered, helical-wound torsional spring mounted on a steel shaft. Spring tension shall be adjustable; connect spring to doors with cable through cable drums. Cable safety factor shall be at least 7 to 1.

### 2.5 ELECTRIC OPERATORS

#### 2.5.1 Operator Features

Provide operators of the drawbar type or side mount (jack shaft) type as recommended by the manufacturer. Operators shall include electric motor, machine-cut reduction gears, steel chain and sprockets, magnetic brake, brackets, pushbutton controls, limit switches, magnetic reversing contactor, a manual chain hoist operator as specified above for emergency use, and other accessories necessary for operation. Design electric operator so motor may be removed without disturbing the limit switch timing and without affecting the manual operator. Provide the operator with slipping clutch coupling to prevent stalling the motor. The emergency manual operator shall be clutch controlled so that it may be engaged and disengaged from the floor; operation shall not affect limit switch timing. The manual operator is not required if door can be manual-pushup operated with a force not to exceed 25 pounds. Provide an electrical or mechanical device that disconnects the motor from the operating mechanism when the manual operator is engaged.

#### 2.5.2 Motors

NEMA MG 1, high-starting torque, reversible type with sufficient horsepower and torque output to move the door in either direction from any position. Motor shall produce a door travel speed of not less than two-thirds foot or more than one foot per second without exceeding the rated capacity. Motors shall operate on current of the characteristics indicated at not more than 3600 rpm. Motors shall be suitable for operation on 480 volts, 60 hertz, 3-phase current and shall be suitable for across-the-line starting. Motors shall be designed to operate at full capacity over a supply voltage variation of plus or minus 10 percent of the motor voltage rating. Motors

shall be provided with overload protection.

### 2.5.3 Controls

Each door motor shall have an enclosed, across-the-line type, magnetic reversing contactor, thermal overload and undervoltage protection, solenoid-operated brake, limit switches, and control switches. Locate control switches as indicated on the drawings so the operator will have complete visibility of the door at all times. Control equipment shall conform to NEMA ICS 1 and NEMA ICS 2. Control enclosures shall be NEMA ICS 6, Type 12 or Type 4, except that contactor enclosures may be Type 1. Each control switch station shall be of the three-button type with buttons marked "OPEN," "CLOSE," and "STOP." The "OPEN" and "STOP" buttons shall require only momentary pressure to operate. The "CLOSE" button shall require constant pressure to maintain the closing motion of the door. If the door is in motion and the "STOP" button is pressed or the "CLOSE" button released, the door shall stop instantly and remain in the stop position; from the stop position, the door may be operated in either direction by the "OPEN" or "CLOSE" button. Pushbuttons shall be full-guarded to prevent accidental operation. Provide limit switches to automatically stop doors at the fully open and closed positions. Limit switch positions shall be readily adjustable.

### 2.5.4 Safety Device

Provide a pneumatic or electric type safety device on the bottom edge of electrically-operated doors. The device shall immediately stop and reverse the door movement during the closing travel upon contact with an obstruction in the door opening or upon failure of any component of the control system. The door-closing circuit shall be automatically locked out and the door shall be operable manually until the failure or damage has been corrected. Do not use the safety device as a limit switch.

### 2.5.5 Control Transformers

NEMA ST 20. Provide transformers in power circuits as necessary to reduce the voltage on the control circuits to 120 volts or less.

### 2.5.6 Electrical Components

NFPA 70. Furnish manual or automatic control and safety devices, including extra flexible Type SO cable and spring-loaded automatic take up reel or equivalent device, as required for operation of the doors. Conduit, wiring, and mounting of controls are specified in Section 16415A, ELECTRICAL WORK, INTERIOR .

## 2.6 WEATHER SEALS AND SAFETY DEVICE

Provide all doors with weatherproof joints between sections by means of tongue-and-groove joints, rabbetted joints, shiplap joints, or wool pile, vinyl or rubber weatherstripping; a rubber, wool pile, or vinyl, adjustable weatherstrip at the top and jambs; and a compressible neoprene, rubber, wool pile, or vinyl weather seal attached to the bottom of the door. All doors bottom seal shall be combination compressible weather seal and safety device for stopping and reversing door movement.

## 2.7 FINISHES

Concealed ferrous metal surfaces and tracks shall be hot-dip galvanized.

Other ferrous metal surfaces, except rollers and lock components, shall be hot-dip galvanized and shop primed.

#### 2.7.1 Galvanized and Shop Primed

Surfaces specified shall have a zinc coating, a phosphate treatment, and a shop prime coat of rust-inhibitive paint. The galvanized coating shall conform to ASTM A 653/A 653M, coating designation G60, for steel sheets, and ASTM A 123/A 123M for assembled steel products. The weight of coatings for assembled products shall be as designated in Table I of ASTM A 123/A 123M for the class of material to be coated. The prime coat shall be a type especially developed for materials treated by phosphates and adapted to application by dipping or spraying. Repair damaged zinc-coated surfaces with galvanizing repair paint and spot prime. A two-part system including bonderizing, baked-on epoxy primer shall be provided by the door manufacturer. Door, tracks, hood and other related equipment topcoat paint finish shall be field applied per the door manufacturer's recommendation and in accordance with SECTION 09900, Painting, General and color as indicated in SECTION 09915, Color Schedule.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

NFPA 70. Install doors in accordance with approved shop drawings and manufacturer's instructions. Upon completion, doors shall be weathertight and free from warp, twist, or distortion. Lubricate and adjust doors to operate freely.

#### 3.2 ELECTRICAL WORK

NFPA 70. Conduit, wiring, and mounting of controls are specified in Section 16415A, ELECTRICAL WORK, INTERIOR.

#### 3.3 TESTING

After installation is complete, operate doors to demonstrate installation and function of operators, safety features, and controls. Correct deficiencies.

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SECTION 08520A

ALUMINUM AND ENVIRONMENTAL CONTROL ALUMINUM WINDOWS

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## SECTION 08520A

ALUMINUM AND ENVIRONMENTAL CONTROL ALUMINUM WINDOWS  
03/00

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

- AAMA 101 (1997) Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors
- AAMA 605 (1998) Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM D 3656 (1997) Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
- ASTM E 283 (1991) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
- ASTM E 330 (1997e1) Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
- ASTM E 331 (1996) Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

## NATIONAL FENESTRATION RATING COUNCIL (NFRC)

- NFRC 100 (1997) Procedure for Determining Fenestration Product U-factors
- NFRC 200 (1997) Procedure for Determining Fenestration Product Solar Heat Gain Coefficients at Normal Incidence

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 101 (1997; Errata 97-1; TIA-97-1) Life Safety

## Code

## 1.2 WINDOW PERFORMANCE

Aluminum windows shall meet the following performance requirements. Testing requirements shall be performed by an independent testing laboratory or agency.

## 1.2.1 Structural Performance

Structural test pressures on window units shall be for positive load (inward) and negative load (outward) in accordance with ASTM E 330. Frames and installation shall be designed in accordance with ASTM E 330 to withstand a minimum wind load of 40 pounds per square foot. After testing, there shall be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms or any other damage which could cause window to be inoperable. There shall be no permanent deformation of any main frame, sash or ventilator member in excess of the requirements established by AAMA 101 for the window types and classification specified in this section.

## 1.2.2 Air Infiltration

Air infiltration shall not exceed 0.01 as established by AAMA 101 for each window type when tested in accordance with ASTM E 283.

## 1.2.3 Water Penetration

Water penetration shall not exceed 15 as established by AAMA 101 for each window type when tested in accordance with ASTM E 331.

## 1.2.4 Thermal Performance

Thermal transmittance for thermally broken aluminum windows with insulating glass shall meet a minimum U-factor of 0.58 Btu/hr-ft<sup>2</sup>-F determined according to NFRC 100. Window units shall comply with the U.S. Department of Energy, Energy Star Window Program for the Northern Climate Zone.

## 1.2.5 Condensation Resistance Factor

The condensation index rating shall be 62 as determined and tested in accordance with IAW AAMA 1503.1.

## 1.2.6 Life Safety Criteria

Windows shall conform to NFPA 101 Life Safety Code when rescue and/or second means of escape are indicated.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Aluminum Windows; G-DO

## Insect Screens; G-DO

Drawings indicating elevations of window, rough-opening dimensions for each type and size of window, full-size sections, thicknesses of metal, fastenings, methods of installation and anchorage, connections with other work, type of wall construction, size and spacing of anchors, method of glazing, types and locations of operating hardware, mullion details, weatherstripping details, screen details including method of attachment, , and window schedules showing locations of each window type.

## SD-03 Product Data

## Aluminum Windows; G-DO

Manufacturer's descriptive data and catalog cut sheets.

Manufacturer's preprinted installation instructions and cleaning instructions.

## SD-04 Samples

## Aluminum Windows; G-DO

Manufacturer's standard color samples of the specified finishes.

## SD-06 Test Reports

## Aluminum Windows;

Reports for each type of aluminum window attesting that identical windows have been tested and meet all performance requirements established under paragraph WINDOW PERFORMANCE.

## SD-07 Certificates

## Aluminum Windows;

Certificates stating that the aluminum windows are AAMA certified conforming to requirements of this section. Labels or markings permanently affixed to the window will be accepted in lieu of certificates. Product ratings determined using NFRC 100 and NFRC 200 shall be authorized for certification and properly labeled by the manufacturer.

## 1.4 QUALIFICATION

Window manufacturer shall specialize in designing and manufacturing the type of aluminum windows specified in this section, and shall have a minimum of 10 years of documented successful experience. Manufacturer shall have the facilities capable of meeting contract requirements, single-source responsibility and warranty.

## 1.5 DELIVERY AND STORAGE

Aluminum windows shall be delivered to project site and stored in accordance with manufacturer's recommendations. Damaged windows shall be replaced with new windows.

## 1.6 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

## PART 2 PRODUCTS

### 2.1 ALUMINUM WINDOW TYPES

Aluminum windows shall consist of complete units including sash, glass, frame, weatherstripping, and hardware. Windows shall conform to AAMA 101. Windows shall be thermal break type double-glazed. Thermal barrier shall be neoprene, rigid vinyl, or polyurethane and shall be resistant to weather. Window members shall be heli-arc welded or angle-reinforced and mechanically joined and sealed. Exposed welded joints shall be dressed and finished. Joints shall be permanent and weathertight. Frames shall be constructed to provide a minimum 1/4 inch thermal break between the exterior and interior frame surfaces. Sash corners shall be internally sealed to prevent air and water leaks.

#### 2.1.1 Awning Windows

Aluminum awning windows shall meet the minimum requirements of the Optimal Performance Class when tested in accordance with AAMA 101 Designation A-HC65 type consisting of hinged ventilators arranged in a single or vertical series within a common frame. Ventilators shall be operated by a roto-type cranking device which shall securely close the ventilator at the window sill without the use of additional manually-controlled locking device. Operating hardware, except ventilator arms and rotary operators, shall be concealed within frame and sill. Ventilator arms shall be concealed when windows are closed.

#### 2.1.2 Casement Windows

Aluminum casement (C) windows shall meet the minimum requirements of the Optimal Performance Class when tested in accordance with AAMA 101 Designation C-HC65 type with ventilators which swing on side jamb. Hinges shall be butt (close-up) type. Operators shall be roto-type cranking as required for hinge type.

#### 2.1.3 Fixed Windows

Aluminum fixed (F) windows shall meet the minimum requirements of the Optimal Performance Class when tested in accordance with AAMA 101 F-HC65 type, non-operable glazed frame, complete with provisions for reglazing in the field.

## 2.2 WEATHERSTRIPPING

Weatherstripping for ventilating sections shall be of type designed to meet water penetration and air infiltration requirements specified in this section in accordance with AAMA 101, and shall be manufactured of material compatible with aluminum and resistant to weather. Weatherstrips shall be factory-applied and easily replaced in the field. Neoprene or polyvinylchloride weatherstripping are not acceptable where exposed to direct sunlight.

## 2.3 INSECT SCREENS

Insect screens shall be aluminum window manufacturer's standard design, and shall be provided where scheduled on drawings. Insect screens shall be fabricated of vinyl coated glass screening conforming to ASTM D 3656.

## 2.4 ACCESSORIES

### 2.4.1 Fasteners

Fastening devices shall be window manufacturer's standard design made from aluminum, non-magnetic stainless steel, cadmium-plated steel, nickel/chrome-plated steel in compliance with AAMA 101. Self-tapping sheet metal screws will not be acceptable for material thicker than 1/16 inch.

### 2.4.2 Hardware

Hardware shall be as specified for each window type and shall be fabricated of aluminum, stainless steel, cadmium-plated steel, zinc-plated steel or nickel/chrome-plated steel in accordance with requirements established by AAMA 101.

### 2.4.3 Window Anchors

Anchoring devices for installing windows shall be made of aluminum, cadmium-plated steel, stainless steel, or zinc-plated steel conforming to AAMA 101.

## 2.5 GLASS AND GLAZING

Aluminum windows shall be designed for inside glazing, field glazing, and for glass types scheduled on drawings and specified in Section 08810AA GLASS AND GLAZING. Units shall be complete with glass and glazing provisions to meet AAMA 101. Glazing material shall be compatible with aluminum, and shall not require painting.

## 2.6 FINISH

### 2.6.1 High-Performance Coating

Exposed surfaces of aluminum windows shall be finished with a two-coat fluoropolymer coating system containing at least 70 percent by weight polyvinylidene fluoride, PVF2 resin, factory-applied, oven-baked, conforming to AAMA 605, with a primer coat of 0.20 to 0.30 mils and a color coat of minimum 1.0 mil, total dry film thickness of 1.20 to 1.3 mils. Finish shall be free of scratches and other blemishes.

### 2.6.2 Color

Color shall be in accordance with Section 09915 COLOR SCHEDULE.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Aluminum windows shall be installed in accordance with approved shop drawings and manufacturer's published instructions. Aluminum surfaces in contact with masonry, concrete, wood and dissimilar metals other than stainless steel, zinc, cadmium or small areas of white bronze, shall be protected from direct contact using protective materials recommended by AAMA 101. The completed window installation shall be watertight in

accordance with Section 07900AA JOINT SEALING. Glass and glazing shall be installed in accordance with requirements of this section and Section 08810A GLASS AND GLAZING.

### 3.2 ADJUSTMENTS AND CLEANING

#### 3.2.1 Hardware Adjustments

Final operating adjustments shall be made after glazing work is complete. Operating sash or ventilators shall operate smoothly and shall be weathertight when in locked position.

#### 3.2.2 Cleaning

Aluminum window finish and glass shall be cleaned on exterior and interior sides in accordance with window manufacturer's recommendations. Alkaline or abrasive agents shall not be used. Precautions shall be taken to avoid scratching or marring window finish and glass surfaces.

-- End of Section --

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DIVISION 08 - DOORS & WINDOWS

SECTION 08710

DOOR HARDWARE

**02/02**

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## SECTION 08710

## DOOR HARDWARE

**02/02**

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 283 (1991) Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

## BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA A156.1 (1997) Butts and Hinges (BHMA 101)

BHMA A156.2 (1996) Bored and Preassembled Locks and Latches (BHMA 601)

BHMA A156.3 (1994) Exit Devices (BHMA 701)

BHMA A156.4 (1992) Door Controls - Closers (BHMA 301)

BHMA A156.5 (1992) Auxiliary Locks & Associated Products (BHMA 501)

BHMA A156.7 (1988) Template Hinge Dimensions

BHMA A156.13 (1994) Mortise Locks & Latches (BHMA 621)

BHMA A156.16 (1997) Auxiliary Hardware

BHMA A156.17 (1993) Self Closing Hinges & Pivots

BHMA A156.18 (1993) Materials and Finishes (BHMA 1301)

BHMA A156.21 (1996) Thresholds

BHMA A156.22 (1996) Door Gasketing Systems

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (1999) Fire Doors and Fire Windows

NFPA 101 (1997) Life Safety Code

## STEEL DOOR INSTITUTE (SDOI)

SDI 100 (1991) Standard Steel Doors and Frames  
 UNDERWRITERS LABORATORIES (UL)

UL Bldg Mat Dir (1999) Building Materials Directory

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-02 Shop Drawings

Hardware schedule; G-DO

Keying system; G-DO

SD-03 Product Data

Hardware items; G-DO

SD-08 Manufacturer's Instructions

Installation

SD-10 Operation and Maintenance Data

Hardware Schedule items, Data Package 1; G-DO

Submit data package in accordance with Section 01781, "Operation and Maintenance Data."

SD-11 Closeout Submittals

Key bitting, G-AO

1.3 HARDWARE SCHEDULE

Prepare and submit hardware schedule in the following form:

Hard- ware Item	Quan- tity	Size	Reference Publi- cation Type No.	Finish	Mfr. Name and Catalog No.	Key Con- trol Symbols	UL Mark (If fire rated and listed)	BHMA Finish Designa- tion
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1.4 KEY BITTING CHART REQUIREMENTS

Submit key bitting charts to the Contracting Officer prior to completion of the work. Include:

- a. Complete listing of all keys (AA1, AA2, etc.).
- b. Complete listing of all key cuts (AA1-123456, AA2-123458).
- c. Tabulation showing which key fits which door.
- d. Copy of floor plan showing doors and door numbers.

- e. Listing of 20 percent more key cuts than are presently required in each master system.

## 1.5 QUALITY ASSURANCE

### 1.5.1 Hardware Manufacturers and Modifications

Provide, as far as feasible, locks, hinges, pivots, and closers of one lock, hinge, or closer manufacturer's make. Modify hardware as necessary to provide features indicated or specified.

## 1.6 DELIVERY, STORAGE, AND HANDLING

Deliver hardware in original individual containers, complete with necessary appurtenances including fasteners and instructions. Mark each individual container with item number as shown in hardware schedule. Deliver permanent keys to the Contracting Officer, either directly or by certified mail.

## PART 2 PRODUCTS

### 2.1 TEMPLATE HARDWARE

Hardware to be applied to metal and to prefinished doors shall be made to template. Promptly furnish template information or templates to door and frame manufacturers. Template hinges shall conform to BHMA A156.7. Coordinate hardware items to prevent interference with other hardware.

### 2.2 HARDWARE FOR FIRE DOORS AND EXIT DOORS

Provide all hardware necessary to meet the requirements of NFPA 80 for fire doors and NFPA 101 for exit doors, as well as to other requirements specified, even if such hardware is not specifically mentioned under paragraph entitled "Hardware Schedule." Such hardware shall bear the label of Underwriters Laboratories, Inc., and be listed in UL Bldg Mat Dir or labeled and listed by another testing laboratory acceptable to the Contracting Officer.

### 2.3 HARDWARE ITEMS

Hinges, pivots, locks, latches, exit devices, bolts, and closers shall be clearly and permanently marked with the manufacturer's name or trademark where it will be visible after the item is installed. For closers with covers, the name or trademark may be beneath the cover.

#### 2.3.1 Hinges

BHMA A156.1, 4 1/2 by 4 1/2 inches unless otherwise specified. Construct loose pin hinges for exterior doors and reverse-bevel interior doors so that pins will be nonremovable when door is closed. Other antifriction bearing hinges may be provided in lieu of ball-bearing hinges.

#### 2.3.2 Pivots

BHMA A156.4.

#### 2.3.3 Spring Hinges

BHMA A156.17.

#### 2.3.4 Locks and Latches

##### 2.3.4.1 Bored Locks and Latches

BHMA A156.2, Series 4000, Grade 1.

##### 2.3.5 Exit Devices

BHMA A156.3, Grade 1. Provide adjustable strikes for rim type and vertical rod devices. Provide open back strikes for pairs of doors with mortise and vertical rod devices. Touch bars shall be provided in lieu of conventional crossbars and arms. Provide escutcheons, not less than 7 by 2 1/4 inches.

##### 2.3.6 Cylinders and Cores

Provide cylinders and cores for new locks, including locks provided under other sections of this specification. Cylinders and cores shall have seven pin tumblers. Cylinders shall be products of one manufacturer, and cores shall be the products of one manufacturer. Rim cylinders, mortise cylinders, and levers of bored locksets shall have interchangeable cores which are removable by special control keys. Stamp each interchangeable core with a key control symbol in a concealed place on the core.

##### 2.3.7 Keying System

Provide a grand master keying system. Provide key cabinet as specified.

Equipment spaces and mechanical rooms shall be keyed separately from the building systems, and shall be keyed alike.

##### 2.3.8 Lock Trim

Cast, forged, or heavy wrought construction and commercial plain design.

##### 2.3.8.1 Lever Handles

Provide lever handles in lieu of knobs. Lever handles for exit devices shall meet the test requirements of BHMA A156.13 for mortise locks. Lever handle locks shall have a breakaway feature (such as a weakened spindle or a shear key) to prevent irreparable damage to the lock when a force in excess of that specified in BHMA A156.13 is applied to the lever handle. Lever handles shall return to within 1/2 inch of the door face.

##### 2.3.8.2 Texture

Provide knurled or abrasive coated knobs or lever handles for doors which are accessible to blind persons and which lead to dangerous areas.

##### 2.3.9 Keys

Furnish one file key, one duplicate key, and one working key for each key change and grand master keying system. Furnish one additional working key for each lock of each keyed-alike group. Furnish two additional keys for each sleeping room. Furnish 3 grand master keys,. Furnish a quantity of key blanks equal to 20 percent of the total number of file keys. Stamp each key with appropriate key control symbol and "State of Montana - Do not duplicate." Do not place room number on keys.

### 2.3.10 Door Bolts

BHMA A156.16. Provide dustproof strikes for bottom bolts and coordinated with doors having metal thresholds.

### 2.3.11 Closers

BHMA A156.4, Series C02000, Grade 1, with PT 4C. Provide with brackets, arms, mounting devices, fasteners, full size covers and other features necessary for the particular application. Size closers in accordance with manufacturer's recommendations, or provide multi-size closers, Sizes 1 through 6, and list sizes in the Hardware Schedule. Provide manufacturer's 10 year warranty.

#### 2.3.11.1 Identification Marking

Engrave each closer with manufacturer's name or trademark, date of manufacture, and manufacturer's size designation located to be visible after installation.

### 2.3.12 Door Stops and Silencers

BHMA A156.16. Silencers Type L03011. Provide three silencers for each single door, two for each pair.

### 2.3.13 Thresholds

BHMA A156.21. Use thresholds with vinyl or silicone rubber insert in face of stop, for doors opening where specified.

### 2.3.14 Weather Stripping Gasketing

BHMA A156.22. Provide the type and function designation where specified in paragraph entitled "Hardware Schedule". A set shall include head and jamb seals, sweep strips, and, for pairs of doors, astragals. Air leakage of weather stripped doors shall not exceed 1.25 cubic feet per minute of air per square foot of door area when tested in accordance with ASTM E 283. Weather stripping type shall be compatible with door type and as recommended by door manufacturer to avoid door closure problems. Weather stripping shall be one of the following:

#### 2.3.14.1 Extruded Aluminum Retainers

Extruded aluminum retainers not less than 0.050 inch wall thickness with vinyl, neoprene, silicone rubber, or polyurethane inserts. Aluminum shall match door color.

### 2.3.15 Rain Drips

Extruded aluminum, not less than 0.08 inch thick, clear anodized and painted to match door frame. Set drips in sealant conforming to Section 07900A, JOINT SEALING, and fasten with stainless steel screws.

#### 2.3.15.1 Door Rain Drips

Approximately 1 1/2 inches high by 5/8 inch projection. Align bottom with bottom edge of door. Door rain drip finishes shall match door frame.

### 2.3.15.2 Overhead Rain Drips

Approximately 1 1/2 inches high by 2 1/2 inches projection, with length equal to overall width of door frame. Align bottom with door frame rabbet. Door rain drip finishes shall match door frame.

### 2.3.16 Special Tools

Provide special tools, such as spanner and socket wrenches and dogging keys, required to service and adjust hardware items.

## 2.4 FASTENERS

Provide fasteners of proper type, quality, size, quantity, and finish with hardware. Fasteners exposed to weather shall be of nonferrous metal or stainless steel. Provide fasteners of type necessary to accomplish a permanent installation.

## 2.5 FINISHES

BHMA A156.18. Hardware shall have BHMA 630 finish (satin stainless steel), unless specified otherwise. Provide items not manufactured in stainless steel in BHMA 626 finish (satin chromium plated) over brass or bronze, except surface door closers which shall have aluminum paint finish. Hinges for exterior doors shall be stainless steel with BHMA 630 finish. Exit devices may be provided in BHMA 626 finish in lieu of BHMA 630 finish.

Exposed parts of concealed closers shall have finish to match lock and door trim. Hardware for aluminum doors shall be finished to match the doors.

Hardware for aluminum doors shall be finished to match the doors. Hardware on interior of bathrooms, toilet and shower rooms shall have BHMA 629 finish (bright stainless steel) or BHMA 625 finish (bright chromium plated).

## 2.6 KEY CABINET AND CONTROL SYSTEM

BHMA A156.5, E8351 (150 hooks). Type required to yield a capacity (number of hooks) 50 percent greater than the number of key changes used for door locks.

# PART 3 EXECUTION

## 3.1 INSTALLATION

Install hardware in accordance with manufacturers' printed instructions. Fasten hardware to wood surfaces with full-threaded wood screws or sheet metal screws. Provide machine screws set in expansion shields for fastening hardware to solid concrete and masonry surfaces. Provide toggle bolts where required for fastening to hollow core construction. Provide through bolts where necessary for satisfactory installation.

### 3.1.1 Weather Stripping Installation

Handle and install weather stripping so as to prevent damage. Provide full contact, weather-tight seals. Doors shall operate without binding. Insulation shall be installed per door manufacturer's recommendations.

### 3.1.2 Threshold Installation

Extend thresholds the full width of the opening and notch end for jamb

stops. Set thresholds in a full bed of sealant and anchor to floor with cadmium-plated, countersunk, steel screws in expansion sleeves.

### 3.2 FIRE DOORS AND EXIT DOORS

Install hardware in accordance with NFPA 80 for fire doors, NFPA 101 for exit doors .

### 3.3 HARDWARE LOCATIONS

SDI 100, unless indicated or specified otherwise.

### 3.4 KEY CABINET AND CONTROL SYSTEM

Locate where indicated on the drawings. Tag one set of file keys and one set of duplicate keys. Place other keys in appropriately marked envelopes, or tag each key. Furnish complete instructions for setup and use of key control system. On tags and envelopes, indicate door and room numbers or master or grand master key.

### 3.5 FIELD QUALITY CONTROL

After installation, protect hardware from paint, stains, blemishes, and other damage until acceptance of work. Submit notice of testing 15 days before scheduled, so that testing can be witnessed by the Contracting Officer. Adjust hinges, locks, latches, bolts, holders, closers, and other items to operate properly. Demonstrate that permanent keys operate respective locks, and give keys to the Contracting Officer. Correct, repair, and finish, as directed, errors in cutting and fitting and damage to adjoining work.

### 3.6 HARDWARE SETS

Hardware for aluminum doors shall be provided under this section. Deliver Hardware templates and hardware, except field-applied hardware to the aluminum door and frame manufacturer for use in fabricating the doors and frames.

#### HW-1

(Exterior pair of doors: 100, 117, 153)

1- 1/2 pair Hinges	Type A5111, for each leaf.
1 Exit Device	Type 6 (narrow stile concealed vertical), Function 04 (Entrance by lever when latch bolt is retracted by key or set in retracted position by key.
1 Door Closure	Type C06051 (recessed floor mounted), for each leaf.
1 Door Stop	Type L02131, for each leaf.
1 Threshold	Type J16190.
1 Weatherseal Strip	for jambs, head, meeting edges of doors & bottoms

#### HW-2

(Interior vestibule pair of doors: 101, 117A, 153A)

1- 1/2 pair Hinges	Type A5111, for each leaf.
1 Push Bar	Type J501, (match door style/color).
1 Door Pull	Type J401, (match door style/color).
1 Door Closure	Type C06051 (recessed floor mounted),for each leaf.

1 Door Stop for each leaf, Type L02141.

HW-3

(Exterior single door: 102, 131, 137)

1- 1/2 pair Hinges Type A5111.  
 1 Exit Device Type 10 (narrow stile mortise), Function  
 04 (Entrance by lever when latch bolt is  
 retracted by key or set in retracted position  
 by key.  
 1 Door Closure Type C06051 (recessed floor mounted).  
 1 Door Stop Type L02131.  
 1 Threshold Type J16190.  
 1 Weatherseal Strip for jambs, head, meeting edges of doors & bottoms  
 1 Door Rain Drip  
 1 Overhead Rain Drip

HW-4

(Interior single door: 102A, 102C, 104, 105, 118)

1/2 pair Hinges Type A8111.  
 1 Latchset Type F75, (passage latch).  
 2 Door Closures Type K81071, (spring loaded hinge)  
 1 Door Stop Type L02251, (wall mounted- concave pad).

HW-5

(Interior operable partition closet door: 102B)

See SECTION: 10650A OPERABLE PARTITIONS; pocket door requirements.

HW-6

(Interior single door: 103, 111, 120)

1/2 pair Hinges Type A8111.  
 1 Latchset Type F75, (passage latch).  
 2 Door Closures Type K81071F, (spring loaded hinge).  
 1 Door Stop Type L02251, (wall mounted- concave pad).

HW-7

(Interior single door: 105A, 106)

1/2 pair Hinges Type A8111.  
 1 Latchset Type F88, (apartment lock).  
 2 Door Closures Type K81071, (spring loaded hinge)  
 1 Door Stop Type L02251, (wall mounted- concave pad).

HW-8

(Interior single door: 118)

1 1/2 pair Hinges Type A8111.  
 1 Latchset Type F75, (passage latch).  
 1 Door Stop Type L02251, (wall mounted- concave pad).

HW-9

(Interior single door: 107, 108, 114, 115)

1/2 pair Hinges	Type A8111.
1 Push Plate	Type J304, (1/8 inch thick plate).
1 Pull / Plate	Type J407, (includes straight door pull).
2 Door Closures	Type K81071, (spring loaded hinge).
1 Door Stop	Type L02251, (wall mounted- concave pad).

HW-10

(Interior single door: 109, 201)

1/2 pair Hinges	Type A8111.
1 Latchset	Type F86, (store room lock).
2 Door Closures	Type K81071F rated- spring loaded hinges).
2 Door Stop	Type L02223, (mount on top & bottom hinge).

HW-11

(Interior single door: 112, 131A, 134, 136)

1/2 pair Hinges	Type A8111.
1 Latchset	Type F75, (passage lock).
2 Door Closures	Type K81071F rated- spring loaded hinges).
1 Door Stop	Type L02251, (wall mounted- concave pad).

HW-12

(Interior single door: 114A, 115A)

1/2 pair Hinges	Type A5111.
1 Latchset	Type F75, (passage lock).
2 Door Closures	Type K81071F rated- spring loaded hinges).
1 Door Stop	Type L02251, (wall mounted- concave pad).
1 Threshold	Type J16190.
1 Weatherseal Strip	for jambs, head & bottoms

HW-13

(Interior single door: 121, 123)

1- 1/2 pair Hinges	Type A8111.
1 Latchset	Type F84, (classroom lock).
1 Door Stop	Type L02251, (wall mounted- concave pad).

HW-14

(Interior single door: 122, 134A)

1/2 pair Hinges	Type A5111.
1 Exit Device	Type 10, (narrow stile mortise), Function 04 (Entrance by lever when latch bolt is retracted by key or set in retracted position by key- door will not be locked by key).
2 Door Closures	Type K81071F rated- spring loaded hinges).
1 Door Stop	Type L02251, (wall mounted- concave pad).
1 Threshold	Type J16190.

1 Weatherseal Strip for jambs, head & bottoms

HW-15

(Interior single door: 124, 128)

1 Latchset                   Type F88, (apartment lock).  
 1 Door Closure            Type K81071F, (spring loaded hinge).  
 1 Door Stop                Type L02251, (wall mounted- concave pad).

HW-16

(Interior single door: 125, 126, 129)

1- 1/2 pair Hinges       Type A8111.  
 1 Latchset                Type F75, (passage lock).  
 1 Door Stop               Type L02251, (wall mounted- concave pad).

HW-17

(Interior single door: 127, 133)

1/2 pair Hinges           Type A5111.  
 1 Exit Device             Type 4, (narrow stile rim), Function  
                               04 (Entrance by lever when latch bolt is  
                               retracted by key or set in retracted position  
                               by key- door will never be locked by key.  
 2 Door Closures          Type K81071F, (spring loaded hinge).  
 1 Door Stop               Type L02251, (wall mounted- concave pad).

HW-18

(Interior single door: 126, 130 )

1- 1/2 pair Hinges       Type A5111.  
 1 Latchset                F76, (bathroom lock)  
 1 Door Stop               Type L02251, (wall mounted- concave pad).

HW-19

(Interior single door: 131B, 135)

1- 1/2 pair Hinges       Type A8111.  
 1 Latchset                Type F75, (passage lock).

HW-20

(Interior single door: 132)

1/2 pair Hinges           Type A8111.  
 1 Latchset                Type F86, (store room lock).  
 2 Door Closures          Type K81071F rated- spring loaded hinges).  
 1 Door Stop               Type L02251, (wall mounted- concave pad).

HW-21

(Exterior pair of doors: 138, 145, 146, 148)

1- 1/2 Pair Hinges       Type A5111, for each leaf.



04 (Entrance by lever when latch bolt is retracted by key or set in retracted position by key- door will never be locked by key.)

1 Door Closure C02011.  
1 Door Stop Type L02251, (wall mounted- concave pad).

HW-26

(Interior single door: 143C, 147A, 148A)

1 1/2 pair Hinges Type A5111.  
1 Exit Device Type 4, (narrow stile rim), Function  
04 (Entrance by lever when latch bolt is retracted by key or set in retracted position by key- door will never be locked by key.)

1 Door Closure C02011.  
2 Door Stop Type L02223, (mounted- top & bottom).

HW-27

(Interior pair of doors: 144C, 151B)

1- 1/2 pair Hinges Type A5111, for each leaf.  
1 Exit Device Type 10 (narrow stile mortise exit device), Function  
04 (Entrance by lever when latch bolt is retracted by key or set in retracted position by key- door will never be locked by key, mounted on active leaf.)

1 Door Closure Type C02051 (holder arm), for active leaf.  
2 Door Stop Type L02223, for inactive leaf.  
2 Lever Bolts L04081, Lever Extension Flush Bolts- mounted top & bottom of door side- inactive leaf.

1 Dust Proof Strike L04021.

HW-28

(Interior overhead rolling door: 147B, 147C, 150A)

See SECTION: 08330A OVERHEAD ROLLING DOORS for requirements.

HW-29

(Interior freezer door: 149)

See SECTION: 11400A walk-in refrigerator equipment for door requirements.

HW-30

(Mezzanine door: 202)

1- 1/2 pair Hinges Type A5111, for each leaf.  
1 Exit Device Type 4, (narrow stile rim), Function  
04 (Entrance by lever when latch bolt is retracted by key or set in retracted position by key- door will never be locked by key.)

1 Threshold Type J12100 (coordinate with mezzanine grating).  
1 Door Stop Type L01361 (holder with keeper).

-- End of Section --

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## DIVISION 08 - DOORS &amp; WINDOWS

## SECTION 08810A

## GLASS AND GLAZING

05/97

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## SECTION 08810A

GLASS AND GLAZING  
05/97

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1 (1984; R 1994) Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 509 (1994) Elastomeric Cellular Preformed Gasket and Sealing Material

ASTM C 669 (1995) Glazing Compounds for Back Bedding and Face Glazing of Metal Sash

ASTM C 864 (1999) Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers

ASTM C 920 (1998) Elastomeric Joint Sealants

ASTM C 1036 (1991; R 1997) Flat Glass

ASTM C 1048 (1997b) Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass

ASTM D 395 (1998) Rubber Property - Compression Set

ASTM E 119 (1998) Fire Tests of Building Construction and Materials

ASTM E 773 (1997) Accelerated Weathering of Sealed Insulating Glass Units

ASTM E 774 (1997) Classification of the Durability of Sealed Insulating Glass Units

ASTM E 1300 (1998) Determining the Minimum Thickness and Type of Glass Required to Resist a Specified Load

## U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-378 (Basic) Putty Linseed Oil Type, (for

Wood-Sash-Glazing)

GLASS ASSOCIATION OF NORTH AMERICA (GANA)

GANA Glazing Manual (1997) Glazing Manual

GANA Standards Manual (1995) Engineering Standards Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (1999) Fire Doors and Fire Windows

NFPA 252 (1995) Fire Tests of Door Assemblies

NFPA 257 (1996) Fire Tests for Window and Glass Block Assemblies

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Installation; G-DO

Drawings showing complete details of the proposed setting methods, mullion details, edge blocking, size of openings, frame details, materials, and types and thickness of glass.

### SD-03 Product Data

Insulating Glass; G-DO  
Glazing Accessories; G-DO

Manufacturer's descriptive product data, handling and storage recommendations, installation instructions, and cleaning instructions.

### SD-04 Samples

Insulating Glass; G-DO

Two 8 x 10 inch samples of each of the following: tinted glass, patterned glass, heat-absorbing glass, and insulating glass units.

### SD-07 Certificates

Insulating Glass;

Certificates stating that the glass meets the specified requirements. Labels or manufacturers marking affixed to the glass will be accepted in lieu of certificates.

## 1.3 SYSTEM DESCRIPTION

Glazing systems shall be fabricated and installed watertight and airtight to withstand thermal movement and wind loading without glass breakage, gasket failure, deterioration of glazing accessories, and defects in the work. Glazed panels shall comply with the safety standards, as indicated in accordance with ANSI Z97.1. Glazed panels shall comply with indicated wind/snow loading in accordance with ASTM E 1300.

#### 1.4 DELIVERY, STORAGE AND HANDLING

Glazing compounds shall be delivered to the site in the manufacturer's unopened containers. Glass shall be stored indoors in a safe, well ventilated dry location in accordance with manufacturer's instructions, and shall not be unpacked until needed for installation. Glass shall not be stored on site over 1 month.

#### 1.5 PROJECT/SITE CONDITIONS

Glazing work shall not be started until outdoor temperature is above 40 degrees F and rising, unless procedures recommended by glass manufacturer and approved by Contracting Officer are made to warm the glass and rabbet surfaces. Ventilation shall be provided to prevent condensation of moisture on glazing work during installation. Glazing work shall not be performed during damp or raining weather.

#### 1.6 WARRANTY

##### 1.6.1 Insulating Glass

Manufacturer shall warrant the insulating glass to be free of fogging or film formation on the internal glass surfaces caused by failure of the hermetic seal for a period of 10 years from Date of Substantial Completion. Warranty certificate shall be signed by a corporate officer with the window manufacturer.

Note: Insulated window units shall have a dehydrated air space, which is hermetically seal at the window manufacturer's factory to the requirements as specified herein. Window units shall be suitable for the Ft. Peck, Montana area and altitude. Installation of capillary vent tubes in the insulated window units at the factory to allow for change of altitude and shipping purposes and latter sealed on-site (Ft. Peck, MT.) shall be considered unacceptable.

##### 1.6.2 Mirror Glass

Manufacturer shall warrant the mirror glass to be free of peeling or deteriorating of coating for a period of 10 years after Date of Substantial Completion. Warranty shall be signed by manufacturer.

### PART 2 PRODUCTS

#### 2.1 FLOAT GLASS

##### 2.1.1 Annealed Glass

Annealed glass shall be Type I transparent flat type, Class 1 - clear, Quality q3 - glazing select, 91 percent light transmittance, 1.04 percent shading coefficient, conforming to ASTM C 1036. Color shall be clear.

##### 2.1.2 Tempered Glass (T), (Display Cabinet Glass Shelving & Door Glazing)

Tempered glass shall be kind FT fully tempered transparent flat type, Class 1-clear, Condition A uncoated surface, Quality q3 - glazing select, 89 percent or greater light transmittance, 1.04 percent shading coefficient conforming to ASTM C 1048 and GANA Standards Manual. Glazing thickness for doors and shelving locations shall exceed manufacturer's recommendations. Color shall be clear.

## 2.2 ROLLED GLASS

### 2.2.1 Wired Glass (WG)

Wired glass shall be Type II flat type, Class 1 - translucent, Quality q8 - glazing, Form 1 - wired and polished both sides, conforming to ASTM C 1036.

Wire mesh shall be polished stainless steel Mesh 1 - diamond. Wired glass for fire-rated windows shall bear an identifying UL label or the label of a nationally recognized testing agency, and shall be rated for 45 minutes when tested in accordance with NFPA 257. Wired glass for fire-rated doors shall be tested as part of a door assembly in accordance with NFPA 252.

## 2.3 INSULATING GLASS

Insulating glazing units shall be 1 inch thick. Units shall be comprised of two- 1/4 inch glass panels separated with a 1/2 inch airspace. Glass shall be Class A preassembled units of dual-seal construction consisting of lites of glass separated by an aluminum, steel, or stainless steel, spacer and dehydrated space conforming to ASTM E 773 and ASTM E 774. Spacer shall be roll-formed, with bent or tightly welded or keyed and sealed joints to completely seal the spacer periphery and eliminate moisture and hydrocarbon vapor transmission into airspace through the corners. Primary seal shall be compressed polyisobutylene and the secondary seal shall be a specially formulated silicone. Glass types shall be as follows:

### 2.3.1 Tempered / Clear Insulating Glass- (T/C) (All Interior Insulating Units)

Glass for insulating units shall be Type I, Class 1 - clear, both glass panes tempered glass, be kind FT fully tempered transparent flat type, Condition A uncoated surface, Quality q3 - glazing select, conforming to ASTM C 1036. Glass performance shall be U-Value/Winter Nighttime 0.48, shading coefficient 80%, and a visible light transmittance of 80%. Color shall be clear.

### 2.3.2 Clear / Low-E Insulating Glass- (C/L) (Exterior Glazing Units)

Interior and exterior glass panes for Low-E insulating units shall be Type I annealed flat glass, Class 1-clear with anti-reflective low-emissivity coating on No. 2 surface (inside surface of exterior pane), Quality q3 - glazing select, conforming to ASTM C 1036. Glass performance shall be U-Value/Winter Nighttime 0.29, shading coefficient 81%, and a visible light transmittance of 69%. Glazing unit shall be PPG (1-800-377-5267)- Solorban 60 or approved equal. Color shall be clear.

### 2.3.3 Tempered /Clear / Low-E Insulating Tempered Glass- (T/C/L) (Exterior Glazing Units)

Interior and exterior glass panes for Low-E insulating units shall be Class 1-clear with anti-reflective low-emissivity coating on No. 2 surface (inside surface of exterior pane), shall have both glass panes tempered glass, be kind FT fully tempered transparent flat type, Class 1-clear, Condition A uncoated surface, Quality q3 - glazing select, 69 percent light transmittance, 81% shading coefficient, and a visible light transmittance of 69% conforming to ASTM C 1048 and GANA Standards Manual. Glass

performance shall be U-Value/Winter Nighttime 0.29, shading coefficient 44%, and a visible light transmittance of 69%. Glazing unit shall be PPG (1-800-377-5267)- Solorban 60 or approved equal. Color shall be clear.

#### 2.4 FIRE/SAFETY RATED GLASS

Fire/safety rated glass shall be laminated Type I transparent flat type, Class 1-clear. Glass rating be in accordance with the wall rating as shown on the drawings. Ratings shall comply with test in accordance with ASTM E 119. Glass shall be permanently labeled with appropriate markings.

#### 2.5 MIRRORS

##### 2.5.1 Glass Mirrors

Glass for mirrors shall be Type I transparent flat type, Class 1-clear, Glazing Quality q1 1/4 inch thick conforming to ASTM C 1036. Glass color shall be clear. Glass shall be coated on one surface with silver coating, copper protective coating, and mirror backing paint. Silver coating shall be highly adhesive pure silver coating of a thickness which shall provide reflectivity of 83 percent or more of incident light when viewed through 1/4 inch thick glass, and shall be free of pinholes or other defects. Copper protective coating shall be pure bright reflective copper, homogeneous without sludge, pinholes or other defects, and shall be of proper thickness to prevent "adhesion pull" by mirror backing paint. Mirror backing paint shall consist of two coats of special scratch and abrasion-resistant paint, and shall be baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication.

##### 2.5.2 Mirror Accessories

###### 2.5.2.1 Mastic

Mastic for setting mirrors shall be a polymer type mirror mastic resistant to water, shock, cracking, vibration and thermal expansion. Mastic shall be compatible with mirror backing paint, and shall be approved by mirror manufacturer.

###### 2.5.2.2 Mirror Frames

Mirrors shall be provided with mirror frames (J-mold channels) fabricated of one-piece roll-formed Type 304 stainless steel with No. 4 brushed satin finish and concealed fasteners which will keep mirrors snug to wall. Frames shall be 1-1/4 x 1/4 x 1/4 inch continuous at top and bottom of mirrors. Concealed fasteners of type to suit wall construction material shall be provided with mirror frames.

###### 2.5.2.3 Mirror Clips

Concealed fasteners of type to suit wall construction material shall be provided with clips.

#### 2.6 GLAZING ACCESSORIES

##### 2.6.1 Preformed Tape

Preformed tape shall be elastomeric rubber extruded into a ribbon of a width and thickness suitable for specific application. Tape shall be of

type which will remain resilient, have excellent adhesion, and be chemically compatible to glass, metal, or wood.

#### 2.6.2 Sealant

Sealant shall be elastomeric conforming to ASTM C 920, Type S or M, Grade NS, Class 12.5, Use G, of type chemically compatible with setting blocks, preformed sealing tape and sealants used in manufacturing insulating glass. Color of sealant shall be as shown in Section 09915 COLOR SCHEDULE.

#### 2.6.3 Glazing Gaskets

Glazing gaskets shall be extruded with continuous integral locking projection designed to engage into metal glass holding members to provide a watertight seal during dynamic loading, building movements and thermal movements. Glazing gaskets for a single glazed opening shall be continuous one-piece units with factory-fabricated injection-molded corners free of flashing and burrs. Glazing gaskets shall be in lengths or units recommended by manufacturer to ensure against pull-back at corners. Glazing gasket profiles shall be as indicated on drawings.

##### 2.6.3.1 Fixed Glazing Gaskets

Fixed glazing gaskets shall be closed-cell (sponge) smooth extruded compression gaskets of cured elastomeric virgin neoprene compounds conforming to ASTM C 509, Type 2, Option 1.

##### 2.6.3.2 Wedge Glazing Gaskets

Wedge glazing gaskets shall be high-quality extrusions of cured elastomeric virgin neoprene compounds, ozone resistant, conforming to ASTM C 864, Option 1, Shore A durometer between 65 and 75.

##### 2.6.3.3 Aluminum Framing Glazing Gaskets

Glazing gaskets for aluminum framing shall be permanent, elastic, non-shrinking, non-migrating, watertight and weathertight.

#### 2.6.4 Putty and Glazing Compound

Glazing compound shall conform to ASTM C 669 for face-glazing metal sash. Putty shall be linseed oil type conforming to CID A-A-378 for face-glazing primed wood sash. Putty and glazing compounds shall not be used with insulating glass or laminated glass.

#### 2.6.5 Setting and Edge Blocking

Neoprene setting blocks shall be dense extruded type conforming to ASTM D 395, Method B, Shore A durometer between 70 and 90. Edge blocking shall be Shore A durometer of 50 (+ or - 5). Silicone setting blocks shall be required when blocks are in contact with silicone sealant. Profiles, lengths and locations shall be as required and recommended in writing by glass manufacturer.

### PART 3 EXECUTION

#### 3.1 PREPARATION

Openings and framing systems scheduled to receive glass shall be examined

for compliance with approved shop drawings, GANA Glazing Manual and glass manufacturer's recommendations including size, squareness, offsets at corners, presence and function of weep system, face and edge clearance requirements and effective sealing between joints of glass-framing members. Detrimental materials shall be removed from glazing rabbet and glass surfaces and wiped dry with solvent. Glazing surfaces shall be dry and free of frost.

### 3.2 INSTALLATION

Glass and glazing work shall be performed in accordance with approved shop drawings, GANA Glazing Manual, glass manufacturer's instructions and warranty requirements. Glass shall be installed with factory labels intact and removed only when instructed. Wired glass and fire/safety rated glass shall be installed in accordance with NFPA 80. Edges and corners shall not be ground, nipped or cut after leaving factory. Springing, forcing or twisting of units during installation will not be permitted.

### 3.3 CLEANING

Upon completion of project, outside surfaces of glass shall be washed clean and the inside surfaces of glass shall be washed and polished in accordance with glass manufacturer's recommendations.

### 3.4 PROTECTION

Glass work shall be protected immediately after installation. Glazed openings shall be identified with suitable warning tapes, cloth or paper flags, attached with non-staining adhesives. Reflective glass shall be protected with a protective material to eliminate any contamination of the reflective coating. Protective material shall be placed far enough away from the coated glass to allow air to circulate to reduce heat buildup and moisture accumulation on the glass. Glass units which are broken, chipped, cracked, abraded, or otherwise damaged during construction activities shall be removed and replaced with new units.

-- End of Section --

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## SECTION 09250

## GYPSUM BOARD

## 11/01

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## SECTION 09250

## GYPSUM BOARD

**11/01**

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- |              |  |
|--------------|--|
| ANSI A108.11 | (1992) Interior Installation of<br>Cementitious Backer Units |
| ANSI A118.9  | (1992) Cementitious Backer Units                             |

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- |                     |  |
|---------------------|--|
| ASTM C 36/C 36M     | (1999) Gypsum Wallboard  |
| ASTM C 442/C 442M   | (1999; Rev. A) Gypsum Backing Board and<br>Coreboard   |
| ASTM C 475          | (1994) Joint Compound and Joint Tape for<br>Finishing Gypsum Board   |
| ASTM C 514          | (1996) Nails for the Application of Gypsum<br>Board  |
| ASTM C 630/C 630M   | (2001) Water-Resistant Gypsum Backing Board  |
| ASTM C 840          | (2001) Application and Finishing of Gypsum<br>Board  |
| ASTM C 954          | (2000) Steel Drill Screws for the<br>Application of Gypsum Board or Metal<br>Plaster Bases to Steel Studs from 0.033<br>in. (0.84 mm) to 0.112 in. (2.84 mm) in<br>Thickness |
| ASTM C 1002         | (2000) Steel Drill Screws for the<br>Application of Gypsum Panel Products or<br>Metal Plaster Bases  |
| ASTM C 1047         | (1999) Accessories for Gypsum Wallboard<br>and Gypsum Veneer Base  |
| ASTM C 1396/C 1396M | (2000) Standard Specification for Gypsum<br>Board  |

## GYPSUM ASSOCIATION (GA)

GA 214	(1996) Recommended Levels of Gypsum Board Finish
GA 216	(2000) Application and Finishing of Gypsum Board
GA 600	(2000) Fire Resistance and Sound Control Design Manual

## UNDERWRITERS LABORATORIES (UL)

UL Fire Resist Dir	(2000) Fire Resistance Directory
--------------------	----------------------------------

## 1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

## SD-03 Product Data

Cementitious backer units; G-AO

Water-Resistant Gypsum Backing Board; G-AO

Accessories; G-AO

Submit for each type of gypsum board and for cementitious backer units.

## SD-07 Certificates

Asbestos Free Materials;

Certify that gypsum board types, gypsum backing board types, cementitious backer units, and joint treating materials do not contain asbestos.

## 1.3 DELIVERY, STORAGE, AND HANDLING

## 1.3.1 Delivery

Deliver materials in the original packages, containers, or bundles with each bearing the brand name, applicable standard designation, and name of manufacturer, or supplier.

## 1.3.2 Storage

Keep materials dry by storing inside a sheltered building. Where necessary to store gypsum board and cementitious backer units outside, store off the ground, properly supported on a level platform, and protected from direct exposure to rain, snow, sunlight, and other extreme weather conditions. Provide adequate ventilation to prevent condensation.

## 1.3.3 Handling

Neatly stack gypsum board and cementitious backer units flat to prevent sagging or damage to the edges, ends, and surfaces.

#### 1.4 ENVIRONMENTAL CONDITIONS

##### 1.4.1 Temperature

Maintain a uniform temperature of not less than 50 degrees F in the structure for at least 48 hours prior to, during, and following the application of gypsum board, cementitious backer units, and joint treatment materials, or the bonding of adhesives.

##### 1.4.2 Exposure to Weather

Protect gypsum board and cementitious backer unit products from direct exposure to rain, snow, sunlight, and other extreme weather conditions.

#### 1.5 QUALIFICATIONS

Manufacturer shall specialize in manufacturing the types of material specified and shall have a minimum of 5 years of documented successful experience. Installer shall specialize in the type of gypsum board work required and shall have a minimum of 3 years of documented successful experience.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

Conform to specifications, standards and requirements specified herein. Provide gypsum board types, gypsum backing board types, cementitious backing units, and joint treating materials manufactured from asbestos free materials only.

##### 2.1.1 Gypsum Board

ASTM C 36/C 36M and ASTM C 1396/C 1396M.

###### 2.1.1.1 Regular

48 inches wide, 5/8 inch thick, tapered and featured edges. Provide tapered and featured edge gypsum board at all panel joint locations.

###### 2.1.1.2 Water-Resistant Gypsum Board

48 inches wide, 5/8 inch thick, tapered and featured edges.

###### 2.1.1.3 Type X (Special Fire-Resistant)

48 inches wide, 5/8 inch thick, tapered and featured edges.

##### 2.1.2 Gypsum Backing Board

ASTM C 442/C 442M, gypsum backing board shall be used as a base in a multilayer system.

###### 2.1.2.1 Regular

48 inches wide, 1/4 and 5/8 inch thick, square edges.

###### 2.1.2.2 Type X (Special Fire-Resistant)

48 inches wide, 5/8 inch thick, square edges.

### 2.1.3 Regular Water-Resistant Gypsum Backing Board

ASTM C 630/C 630M

#### 2.1.3.1 Regular

48 inches wide, 5/8 inch thick, tapered edges.

#### 2.1.3.2 Type X (Special Fire-Resistant)

48 inches wide, 5/8 inch thick, tapered edges.

### 2.1.4 Cementitious Backer Units

ANSI A118.9.

### 2.1.5 Joint Treatment Materials

ASTM C 475.

#### 2.1.5.1 Embedding Compound

Specifically formulated and manufactured for use in embedding tape at gypsum board joints and compatible with tape, substrate and fasteners.

#### 2.1.5.2 Finishing or Topping Compound

Specifically formulated and manufactured for use as a finishing compound.

#### 2.1.5.3 All-Purpose Compound

Specifically formulated and manufactured to serve as both a taping and a finishing compound and compatible with tape, substrate and fasteners.

#### 2.1.5.4 Setting or Hardening Type Compound

Specifically formulated and manufactured for use with fiber glass mesh tape.

#### 2.1.5.5 Joint Tape

Cross-laminated, tapered edge, reinforced paper, or fiber glass mesh tape recommended by the manufacturer.

### 2.1.6 Fasteners

#### 2.1.6.1 Nails

ASTM C 514.

#### 2.1.6.2 Screws

ASTM C 1002, Type "G", Type "S" or Type "W" steel drill screws for fastening gypsum board to gypsum board, wood framing members and steel framing members less than 0.033 inch thick. ASTM C 954 steel drill screws for fastening gypsum board to steel framing members 0.033 to 0.112 inch thick. Provide cementitious backer unit screws with a polymer coating.

### 2.1.7 Adhesives

Do not use adhesive containing benzene, carbon tetrachloride, or trichloroethylene.

#### 2.1.7.1 Adhesive for Fastening Gypsum Board to Metal Framing

Type recommended by gypsum board manufacturer.

#### 2.1.7.2 Adhesive for Laminating

For laminating two-ply gypsum board systems, provide adhesive recommended by gypsum board manufacturer.

### 2.1.8 Gypsum Studs

One inch minimum thickness width. Studs may be of one inch thick gypsum board or multi layers laminated to required thickness. Conform to ASTM C 36/C 36M or ASTM C 442/C 442M for material.

### 2.1.9 Shaftwall Liner Panel

ASTM C 442/C 442M. Shaftwall liner panel shall conform to UL Fire Resist Dir for the Design Number(s) indicated. Liner Panel shall be specifically manufactured for cavity shaftwall system, with water-resistant paper faces, bevel edges, single lengths to fit required conditions, 1" thick, by 24" wide. Shaftwall framing and gypsum board panel assembly shall be UL Des U415, 1 hour rated and approximately 3 1/8 inch thickness.

### 2.1.10 Accessories

ASTM C 1047. Fabricate from corrosion protected steel or plastic designed for intended use. Accessories manufactured with paper flanges are not acceptable. Flanges shall be free of dirt, grease, and other materials that may adversely affect bond of joint treatment. Provide prefinished or job decorated materials.

### 2.1.11 Water

Clean, fresh, and potable.

## PART 3 EXECUTION

### 3.1 EXAMINATION

#### 3.1.1 Framing and Furring

Verify that framing and furring are securely attached and of sizes and spacing to provide a suitable substrate to receive gypsum board and cementitious backer units. Verify that all blocking, headers and supports are in place to support plumbing fixtures and to receive soap dishes, grab bars, towel racks, and similar items. Do not proceed with work until framing and furring are acceptable for application of gypsum board and cementitious backer units.

#### 3.1.2 Gypsum Board and Framing

Verify that surfaces of gypsum board and framing to be bonded with an adhesive are free of dust, dirt, grease, and any other foreign matter. Do

not proceed with work until surfaces are acceptable for application of gypsum board with adhesive.

### 3.2 APPLICATION OF GYPSUM BOARD

Apply gypsum board to framing and furring members in accordance with ASTM C 840 or GA 216 and the requirements specified herein. Apply gypsum board with separate panels in moderate contact; do not force in place. Stagger end joints of adjoining panels. Neatly fit abutting end and edge joints. Use gypsum board of maximum practical length. Cut out gypsum board as required to make neat close joints around openings. In vertical application of gypsum board, provide panels in lengths required to reach full height of vertical surfaces in one continuous piece. Surfaces of gypsum board and substrate members may be bonded together with an adhesive, except where prohibited by fire rating(s). Treat edges of cutouts for plumbing pipes, screw heads, and joints with water-resistant compound as recommended by the gypsum board manufacturer. Provide type of gypsum board for use in each system specified herein as indicated.

#### 3.2.1 Application of Gypsum Board to Steel Framing and Furring

Apply in accordance with ASTM C 840, System VIII or GA 216. In addition, gypsum board wall, shaft wall, and ceiling framing shall meet or exceed a minimum of 10 psf loading with a maximum mid span deflection of  $L/360$ . However, all steel stud framing for metal wall panels and gypsum wallboard partitions located in the following rooms; 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151 & 152 shall have a minimum of 15 psf loading with a maximum mid span deflection of  $L/360$ .

#### 3.2.2 Floating Interior Angles

Locate the attachment fasteners adjacent to ceiling and wall intersections in accordance with ASTM C 840, System XII or GA 216, for single-ply and two-ply applications of gypsum board to wood framing.

#### 3.2.3 Control Joints

Install expansion and contraction joints in ceilings and walls in accordance with ASTM C 840, System XIII or GA 216, unless indicated otherwise. Control joints between studs in fire-rated construction shall be filled with firesafing insulation to match the fire-rating of construction.

### 3.3 APPLICATION OF CEMENTITIOUS BACKER UNITS

#### 3.3.1 Application

In wet areas (tubs and shower enclosure rooms), apply cementitious backer units in accordance with ANSI A108.11. A 15 lb asphalt impregnated, continuous felt paper membrane shall be placed behind cementitious backer units, between backer units and studs or base layer of gypsum board. Membrane shall be placed with a minimum 6 inch overlap of sheets laid shingle style.

#### 3.3.2 Joint Treatment

ANSI A108.11.

### 3.4 FINISHING OF GYPSUM BOARD

Tape and finish gypsum board in accordance with ASTM C 840, GA 214 and GA 216. Plenum areas above ceilings shall be finished to Level 1 in accordance with GA 214. Walls and ceilings to receive a heavy-grade wall covering or heavy textured finish before painting shall be finished to Level 3 in accordance with GA 214. Unless otherwise specified, all gypsum board walls, partitions and ceilings shall be finished to Level 5 in accordance with GA 214. Provide joint, fastener depression, and corner treatment. Do not use fiber glass mesh tape with conventional drying type joint compounds; use setting or hardening type compounds only. Provide treatment for water-resistant gypsum board as recommended by the gypsum board manufacturer.

#### 3.4.1 Uniform Surface

In accordance with GA 214 Level 5, apply a thin skim coat of joint compound to the entire gypsum board surface, after the two-coat joint and fastener treatment is complete and dry.

#### 3.5 SEALING

Seal openings around pipes, fixtures, and other items projecting through gypsum board and cementitious backer units as specified in Section 07900A JOINT SEALING. Apply material with exposed surface flush with gypsum board or cementitious backer units.

#### 3.6 FIRE-RESISTANT ASSEMBLIES

Wherever fire-rated construction is indicated, provide materials and application methods, including types and spacing of fasteners, wall and ceiling framing in accordance with the specifications contained in UL Fire Resist Dir or GA 600 for the design configurations shown on the drawings. Joints of fire-rated gypsum board enclosures shall be closed and sealed in accordance with UL test requirements or GA requirements. Penetrations through rated partitions and ceilings shall be sealed tight in accordance with tested systems. Fire ratings shall be as indicated.

#### 3.7 PATCHING

Patch surface defects in gypsum board to a smooth, uniform appearance, ready to receive finish as specified.

#### 3.8 ROOF / WALL FRAMING ASSEMBLY

Gypsum Board wall partitions extending to the roof deck shall be installed in accordance with the wall partition and roofing manufacturer's published recommendations. Gypsum board wall partition framing connection assemblies to the roof deck shall allow for a minimum one inch of roof deflection and a minimum of one inch roof extension for a combined range of movement of two inches without damage to the wall partition and without compromising the fire rating of rated wall partitions. In addition, the wall framing partition anchoring connection to the roofing deck shall not compromise the water resistant of the roofing assembly. Wall framing connections shall be similar to Fire Trak Corporation (1-800-394-9875) or approved equal.

#### 3.9 WATER-RESISTANT GYPSUM BOARD APPLICATIONS

Water resistant gypsum board type shall be applied to all wet area walls and ceilings. Wet areas shall include the following rooms: #107, 108, 109,

113, 114, 115, 126, 130, 141, 142, 143, 144, 145, 147, 148, 150, 151 &  
152.

### 3.10 SHAFT WALL FRAMING

The shaft wall system shall be installed in accordance with the system manufacturer's published instructions. Bucks, anchors, blocking and other items placed in or behind shaft wall framing shall be coordinated with electrical and mechanical work. Fireproofing materials which are damaged or removed during shaft wall construction shall be patched or replaced.

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## SECTION 09310

## CERAMIC TILE AND PORCELAIN TILE

8/02

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A108.1A	(1992) Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar
ANSI A108.1B	(1992) Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar
ANSI A108.5	(1992) Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar
ANSI A108.10	(1992) Installation of Grout in Tilework
ANSI A118.1	(1992) Dry-Set Portland Cement Mortar
ANSI A118.4	(1992) Latex-Portland Cement Mortar
ANSI A118.6	(1992) Ceramic Tile Grouts
ANSI A137.1	(1988) Ceramic Tile

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 185	(1997) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM C 33	(1999ael) Concrete Aggregates
ASTM C 144	(1999) Aggregate for Masonry Mortar
ASTM C 150	(1999a) Portland Cement
ASTM C 206	(1984; R 1997) Finishing Hydrated Lime
ASTM C 207	(1991; R 1997) Hydrated Lime for Masonry Purposes
ASTM C 241	(1997) Abrasion Resistance of Stone Subjected to Foot Traffic

ASTM C 373	(1988; R 1994) Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products
ASTM C 482	(1981; R 1996) Bond Strength of Ceramic Tile to Portland Cement
ASTM C 501	(1984; R 1996) Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser
ASTM C 648	(1998) Breaking Strength of Ceramic Tile
ASTM C 1026	(1987; R 1996) Measuring the Resistance of Ceramic Tile to Freeze-Thaw Cycling
ASTM C 1027	(1999) Determining Visible Abrasion Resistance of Glazed Ceramic Tile
ASTM C 1028	(1996) Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method
ASTM F 446	(1985; R 1993) Grab Bars and Accessories Installed in Bathing Area

MARBLE INSTITUTE OF AMERICA (MIA)

MIA Design Manual (1991) Design Manual IV Dimensional Stone

TILE COUNCIL OF AMERICA (TCA)

TCA Hdbk (1997) Handbook for Ceramic Tile Installation

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation; G-DO

Three copies of drawings indicating areas receiving ceramic tile patterns, showing color location and pattern dimensions.

SD-03 Product Data

Tile; G-DO  
Setting-Bed; G-DO  
Mortar, Grout, and Adhesive; G-DO

Manufacturer's catalog data and preprinted installation and cleaning instructions.

#### SD-04 Samples

Tile; G-DO  
Grout; G-DO  
Accessories; G-DO  
Marble Thresholds; G-DO

Samples of sufficient size to show color range, pattern, type and joints.

#### SD-07 Certificates

Tile;  
Mortar, Grout, and Adhesive;

Certificates indicating conformance with specified requirements. A master grade certificate shall be furnished for tile.

### 1.3 DELIVERY AND STORAGE

Materials shall be delivered to the project site in manufacturer's original unopened containers with seals unbroken and labels and hallmarks intact. Materials shall be kept dry, protected from weather, and stored under cover in accordance with manufacturer's instructions.

### 1.4 ENVIRONMENTAL REQUIREMENTS

Ceramic tile work shall not be performed unless the substrate and ambient temperature is at least 50 degrees F and rising. Temperature shall be maintained above 50 degrees F while the work is being performed and for at least 7 days after completion of the work. When temporary heaters are used they shall be vented to the outside to avoid carbon dioxide damage to new tilework.

### 1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1-year period shall be provided.

### 1.6 EXTRA STOCK

Supply an extra two percent of each type tile used in clean and marked cartons.

## PART 2 PRODUCTS

### 2.1 TILE

Tile shall be standard grade conforming to ANSI A137.1. Containers shall be grade sealed. Seals shall be marked to correspond with the marks on the signed master grade certificate. Tile shall be impact resistant with a minimum breaking strength for wall tile of 90 lbs and 250 lbs for floor tile in accordance with ASTM C 648. Tile for cold climate projects shall be rated frost resistant by the manufacturer as determined by ASTM C 1026. Water absorption shall be 0.50 maximum percent in accordance with ASTM C 373. Floor tile shall have a minimum coefficient of friction of 0.60 wet and

dry in accordance with ASTM C 1028. Unless otherwise noted, floor tile shall be a minimum Class IV-Heavy Traffic, durability classification as rated by the manufacturer when tested in accordance with ASTM C 1027 for abrasion resistance as related to foot traffic. Color shall be in accordance with Section 09915 COLOR SCHEDULE.

#### 2.1.1 Mosaic Tile

Ceramic mosaic tile and trim shall be unglazed porcelain with cushioned edge. Tile size shall be 2 x 2 inches. Color shall be in accordance with Section 09915 COLOR SCHEDULE.

#### 2.1.2 Porcelain Tile

Porcelain tile and trim shall have color extending uniformly through the body of the tile. Unless otherwise noted, floor and wall tile size shall be nominal 12 by 12 inches by 3/8 inch thick. Porcelain tile PT-3 shall be a nominal 1/4 inch thick. Wall base shall be coved. Tile shall meet or exceed the following criteria: Abrasive wear in accordance with ASTM C 501 and bonding strength in accordance with ASTM C 482. Color shall be in accordance with Section 09915 COLOR SCHEDULE.

#### 2.1.3 Glazed Wall Tile

Glazed wall tile and trim shall be cushion edged with semi-matte or matte glaze. Tile shall be 4-1/4 x 4-1/4 or 4 3/8 x 4 3/8 inches. Color shall be in accordance with Section 09915 COLOR SCHEDULE.

#### 2.1.4 Accessories

Accessories shall be the built-in type of the same materials and finish as the wall tile. Accessories shall be provided as follows:

	Quantity	Location
a. Recessed Soap Holders (RSH) and hand hold combination: support static load in compliance with ASTM F 446	1	Rm. #126
	1	Rm. #130
	2	Rm. #114
	2	Rm. #115
b. Towel Bars (TB), stainless steel 24 inches long, two towel posts	1	Rm. #124
	1	Rm. #128
c. Towel Bars (TB), stainless steel 30 inches long, two towel posts	1	Rm. #126
	1	Rm. #130
d. Robe Hooks (RH)	5	Rm. #114
	5	Rm. #115
e. Toilet Paper Holder (TPH)	1	Rm. #126
	1	Rm. #130

#### 2.2 SETTING-BED

The setting-bed shall be composed of the following:

##### 2.2.1 Aggregate for Concrete Fill

Aggregate shall conform to ASTM C 33. Maximum size of coarse aggregate shall not be greater than one-half the thickness of concrete fill.

#### 2.2.2 Portland Cement

Cement shall conform to ASTM C 150, Type I, white for wall mortar and gray for other uses.

#### 2.2.3 Sand

Sand shall conform to ASTM C 144.

#### 2.2.4 Hydrated Lime

Hydrated lime shall conform to ASTM C 206, Type S or ASTM C 207, Type S.

#### 2.2.5 Reinforcing Wire Fabric

Wire fabric shall conform to ASTM A 185. Wire shall be either 2 x 2 inch mesh, 16/16 wire or 1-1/2 x 2 inch mesh, 16/13 wire.

#### 2.3 WATER

Water shall be potable.

#### 2.4 MORTAR AND GROUT

Mortar and grout shall conform to the following:

##### 2.4.1 Dry-Set Portland Cement Mortar

ANSI A118.1.

##### 2.4.2 Latex-Portland Cement Mortar

ANSI A118.4.

##### 2.4.3 Ceramic Tile Grout

ANSI A118.6; dry-set grout or latex-portland cement grout.

##### 2.4.4 Cementitious Backer Board

Cementitious backer units shall be 1/2 inch thick.

#### 2.5 MARBLE THRESHOLDS

Marble thresholds shall be of size required by drawings or conditions. Marble shall be Group A as classified by MIA Design Manual. Marble shall have a fine sand-rubbed finish and color shall be as specified in Section 09915 Color Schedule. Marble abrasion shall be not less than 12.0 when tested in accordance with ASTM C 241.

### PART 3 EXECUTION

#### 3.1 PREPARATORY WORK AND WORKMANSHIP

Surface to receive tile shall be inspected and shall conform to the

requirements of ANSI A108.1A or ANSI A108.1B for surface conditions for the type setting bed specified and for workmanship. Variations of surface to be tiled shall fall within maximum values shown below:

TYPE	WALLS	FLOORS
Dry-Set Mortar	1/8 inch in 8 ft.	1/8 inch in 10 ft.
Latex portland cement mortar	1/8 inch in 8 ft.	1/8 inch in 10 ft.

### 3.2 GENERAL INSTALLATION REQUIREMENTS

Tile work shall not be started until roughing in for mechanical and electrical work has been completed and tested, and built-in items requiring membrane waterproofing have been installed and tested. Floor tile installation shall not be started in spaces requiring wall tile until after wall tile has been installed. Tile patterns shall be installed as shown on the drawings. Tile shall be installed with the respective surfaces in true even planes to the elevations and grades shown. Special shapes shall be provided as required for sills, jambs, recesses, offsets, external corners, and other conditions to provide a complete and neatly finished installation. Tile bases and coves shall be solidly backed with mortar.

### 3.3 INSTALLATION OF WALL TILE

Wall tile shall be installed in accordance with the TCA Hdbk, method W244 (All wall areas), method B412 (Showers in Rm #126 & #130)

#### 3.3.1 Workable or Cured Mortar Bed

Tile shall be installed over a workable mortar bed or a cured mortar bed at the option of the Contractor. A 4 mil polyethylene membrane, metal lath, and scratch coat shall also be installed. Workable mortar bed, materials, and installation of tile shall conform to ANSI A108.1A. Cured mortar bed and materials shall conform to ANSI A108.1B.

#### 3.3.2 Dry-Set Mortar and Latex-Portland Cement Mortar

Dry-set or latex-portland cement shall be used to install tile in accordance with ANSI A108.5. Latex portland cement shall be used when installing porcelain ceramic tile.

### 3.4 INSTALLATION OF FLOOR TILE

Floor tile shall be installed in accordance with TCA Hdbk, method F112 (Rooms #114 & #115), method B415 (Showers in Rm #114 & #115), method F113 (all other tile floor areas).

#### 3.4.1 Workable or Cured Mortar Bed

Floor tile shall be installed over a workable mortar bed or a cured mortar bed at the option of the Contractor. Workable mortar bed materials and installation shall conform to ANSI A108.1A. Cured mortar bed and materials shall conform to ANSI A108.1B. Joints between quarry tile shall be between 1/4 inch and 3/8 inch in width and shall be uniform in width.

### 3.4.2 Dry-Set and Latex-Portland Cement

Dry-set or latex-portland cement mortar shall be used to install tile directly over properly cured, plane, clean concrete slabs in accordance with ANSI A108.5. Latex portland cement shall be used when installing floor tile.

### 3.4.3 Ceramic Tile Grout

Ceramic Tile grout shall be prepared and installed in accordance with ANSI A108.10.

### 3.4.4 Waterproofing

Shower pans are specified in Section 15400A PLUMBING, GENERAL PURPOSE.

### 3.4.5 Concrete Fill

Concrete fill shall be 3500 psi concrete, mixed to as dry a consistency as practicable. The fill shall be spread, tamped, and screeded to a true plane, and pitched to drains or leveled as shown. Concrete fill shall be thoroughly damp cured before application of setting-bed material. Concrete fill shall be reinforced with one layer of reinforcement, with the uncut edges lapped the width of one mesh and the cut ends and edges lapped not less than 2 inches. Laps shall be tied together with 18 gauge wire every 10 inches along the finished edges and every 6 inches along the cut ends and edges. The reinforcement shall be supported and secured in the centers of concrete fills. The mesh shall be continuous; except where expansion joints occur, mesh shall be cut and discontinued across such joints. Reinforced concrete fill shall be provided under the setting-bed where the distance between the under-floor surface and the finished tile floor surface is 2 inches or greater, and shall be of such thickness that the mortar setting-bed over the concrete fill shall be not less nor more than the thickness required in the specified TCA Hdbk methods.

## 3.5 INSTALLATION OF MARBLE THRESHOLDS

Thresholds shall be installed where indicated in a manner similar to that of the ceramic tile floor. Thresholds shall be the full width of the opening. Head joints at ends shall not exceed 1/4 inch in width and shall be grouted full as specified for ceramic tile.

## 3.6 EXPANSION JOINTS

Joints shall be formed as indicated and sealed as specified in Section 07900A JOINT SEALING.

### 3.6.1 Walls

Expansion joints shall be provided at control joints in backing material. Wherever backing material changes, an expansion joint shall be installed to separate the different materials.

### 3.6.2 Floors

Expansion joints shall be provided over construction joints, control joints, and expansion joints in concrete slabs. Expansion joints shall be provided where tile abuts restraining surfaces such as perimeter walls, curbs and columns and at intervals of 24 to 36 feet each way in large

interior floor areas and 12 to 16 feet each way in large exterior areas or areas exposed to direct sunlight or moisture. Expansion joints shall extend through setting-beds and fill.

### 3.7 CLEANING AND PROTECTING

Upon completion, tile surfaces shall be thoroughly cleaned in accordance with manufacturer's approved cleaning instructions. Acid shall not be used for cleaning glazed tile. Floor tile with resinous grout or with factory mixed grout shall be cleaned in accordance with instructions of the grout manufacturer. After the grout has set, tile wall surfaces shall be given a protective coat of a noncorrosive soap or other approved method of protection. Tiled floor areas shall be covered with building paper before foot traffic is permitted over the finished tile floors. Board walkways shall be laid on tiled floors that are to be continuously used as passageways by workmen. Damaged or defective tiles shall be replaced.

-- End of Section --

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-- End of Section Table of Contents --

## SECTION 09510

## ACOUSTICAL CEILINGS

07/02

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 366/A 366M	(1997e1) Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality
ASTM A 641/A 641M	(1998) Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM A 653/A 653M	(2001a) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B 633	(1998e1) Electrodeposited Coatings of Zinc on Iron and Steel
ASTM C 423	(2001) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM C 635	(2000) Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
ASTM C 636	(1996) Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
ASTM C 834	(2000e1) Latex Sealants
ASTM E 580	(2000) Application of Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels in Areas Requiring Moderate Seismic Restraint
ASTM E 1264	(1998) Acoustical Ceiling Products
ASTM E 1414	(2000a) Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
ASTM E 1477	(1998a) Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers

U.S. ARMY CORPS OF ENGINEERS (USACE)

TI 809-04 (1998) Seismic Design for Buildings

UNDERWRITERS LABORATORIES (UL)

UL Fire Resist Dir (1999) Fire Resistance Directory (2 Vol.)

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Approved Detail Drawings; G-DO,

Drawings showing suspension system, method of anchoring and fastening, details, and reflected ceiling plan.

### SD-03 Product Data

Acoustical Ceiling Systems; G-DO,

Manufacturer's descriptive data, catalog cuts, and installation instructions. Submittals which do not provide adequate data for the product evaluation will be rejected.

### SD-04 Samples

Acoustical Units; G-DO,

Two samples of each type of acoustical unit and each type of suspension grid tee section showing texture, finish, and color.

### SD-06 Test Reports

Fire Resistive Ceilings;  
Ceiling Attenuation Class and Test;

Reports by an independent testing laboratory attesting that acoustical ceiling systems meet specified sound transmission requirements. Data attesting to conformance of the proposed system to Underwriters Laboratories requirements for the fire endurance rating listed in UL Fire Resist Dir may be submitted in lieu of test reports.

### SD-07 Certificates

Acoustical Units;

Certificate attesting that the mineral based acoustical units furnished for the project contain recycled material and showing an estimated percent of such material.

### 1.3 GENERAL REQUIREMENTS

Acoustical treatment shall consist of sound controlling units mechanically mounted on a ceiling suspension system. The unit size, texture, finish, and color shall be as specified. The Contractor shall coordinate the whole ceiling system with other details, like location of access panels, ceiling video projector and screen, operable wall partitions, and ceiling penetrations, etc., as shown on the drawings. The location and extent of acoustical treatment shall be as shown on the approved detail drawings. Reclamation of mineral fiber acoustical ceiling panels to be removed from the job site shall be in accordance with paragraph RECLAMATION PROCEDURES.

#### 1.3.1 Ceiling Attenuation Class and Test

The ceiling attenuation class (CAC) of the ceiling system shall be in accordance with ASTM E 1414. Provide fixture attenuators over light fixtures and other ceiling penetrations, and provide acoustical blanket insulation adjacent to partitions, as required to achieve the specified CAC. Test ceiling shall be continuous at the partition and shall be assembled in the suspension system in the same manner that the ceiling will be installed on the project.

#### 1.3.2 Ceiling Sound Absorption

Determine the NRC in accordance with ASTM C 423 Method of Test.

#### 1.3.3 Light Reflectance

Determine light reflectance factor in accordance with ASTM E 1477 Test Method.

### 1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Materials shall be carefully handled and stored in dry, watertight enclosures. Immediately before installation, acoustical units shall be stored for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed in order to assure proper temperature and moisture acclimation.

### 1.5 ENVIRONMENTAL REQUIREMENTS

A uniform temperature of not less than 60 degrees F nor more than 85 degrees F and a relative humidity of not more than 70 percent shall be maintained for 24 hours before, during, and 24 hours after installation of acoustical units.

### 1.6 SCHEDULING

Interior finish work such as plastering, concrete and terrazzo work shall be complete and dry before installation. Mechanical, electrical, and other work above the ceiling line shall be completed and heating, ventilating, and air conditioning systems shall be installed and operating in order to maintain temperature and humidity requirements.

### 1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend

beyond a one year period shall be provided. Standard performance guarantee or warranty shall contain an agreement to repair or replace acoustical panels that fail within the warranty period. Failures include, but are not limited to, sagging and warping of panels; rusting and manufacturers defects of grid system.

#### 1.8 EXTRA MATERIALS

Spare tiles of each color shall be furnished at the rate of 5 tiles for each 1000 tiles installed. Tiles shall be from the same lot as those installed.

### PART 2 PRODUCTS

#### 2.1 ACOUSTICAL UNITS

Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS. Acoustical units shall conform to ASTM E 1264, Class A, and the following requirements:

##### 2.1.1 Units for Exposed-Grid System

Type: III (non-asbestos mineral fiber with painted finish), Form 4, acoustical units shall have a minimum recycled material content of 18 percent.

Minimum NRC:	0.60 to 0.70.
Pattern:	E.
Nominal size:	24 by 24 inches.
Edge detail:	Narrow Revealed Edge (9/16 inch grid), (item H- Elite Narrow Stab)
Finish:	Factory-applied standard color and finish.
Minimum LR coefficient:	0.74.
Minimum CAC:	20-24.
Flame Spread:	Class A, 25 or less

This acoustical tile specification is similar to the "Natural Fissured" acoustical tile as manufactured by Celotex (1-800-CELOTEX). Other manufacturer products will be approved that can meet or exceed the aforementioned performance requirements.

#### 2.2 SUSPENSION SYSTEM

Suspension system shall be standard narrow width flange and conform to ASTM C 635 for intermediate-duty systems. Surfaces exposed to view shall be aluminum or steel with a factory-applied white color baked-enamel finish. Wall molding shall have a flange of not less than 15/16 inch. Standard corners shall be provided. Suspended ceiling framing system shall have the capability to support the finished ceiling, light fixtures, air diffusers, and accessories, as shown. The suspension system shall have a maximum deflection of 1/360 of span length. Seismic details shall conform to the guidance in TI 809-04 and ASTM E 580.

## 2.3 HANGERS

Hangers and attachment shall support a minimum 300 pound ultimate vertical load without failure of supporting material or attachment.

### 2.3.1 Wires

Wires shall conform to ASTM A 641/A 641M, Class 1, 0.106 inches in diameter.

### 2.3.2 Straps

Straps shall be 1 by 3/16 inch galvanized steel conforming to ASTM A 653/A 653M, with a light commercial zinc coating or ASTM A 366/A 366M with an electrodeposited zinc coating conforming to ASTM B 633, Type RS.

### 2.3.3 Rods

Rods shall be 3/16 inch diameter threaded steel rods, zinc or cadmium coated.

## 2.4 ADHESIVE

Adhesive shall be as recommended by tile manufacturer.

## 2.5 FINISHES

Acoustical units and suspension system members shall have manufacturer's standard textures, patterns and finishes as specified. Ceiling suspension system components shall be treated to inhibit corrosion.

## 2.6 COLORS AND PATTERNS

Colors and patterns for acoustical units and suspension system components shall be as specified in Section 09915 COLOR SCHEDULE.

## 2.7 ACOUSTICAL SEALANT

Acoustical sealant shall conform to ASTM C 834, nonstaining.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Examine surfaces to receive directly attached acoustical units for unevenness, irregularities, and dampness that would affect quality and execution of the work. Areas where acoustical units will be cemented shall be free of oils, form residue, or other materials that reduce bonding capabilities of the adhesive. Interior finish work such as plastering, concrete, and terrazzo work shall be completed and dry before installation.

Mechanical, electrical, and other work above the ceiling line shall be completed and approved prior to the start of acoustical ceiling installation. Acoustical work shall be provided complete with necessary fastenings, clips, and other accessories required for a complete installation. Mechanical fastenings shall not be exposed in the finished work. Hangers shall be laid out for each individual room or space. Hangers shall be placed to support framing around beams, ducts, columns, grilles, and other penetrations through ceilings. Main runners and carrying channels shall be kept clear of abutting walls and partitions. At

least two main runners shall be provided for each ceiling span. Wherever required to bypass an object with the hanger wires, a subsuspension system shall be installed, so that all hanger wires will be plumb.

### 3.1.1 Suspension System

Suspension system shall be installed in accordance with ASTM C 636 and as specified herein. There shall be no hanger wires or other loads suspended from underside of steel decking.

#### 3.1.1.1 Plumb Hangers

Hangers shall be plumb and shall not press against insulation covering ducts and pipes. Where lighting fixtures are supported from the suspended ceiling system, hangers shall be provided at a minimum of four hangers per fixture and located not more than 6 inches from each corner of each fixture. See Section 16415A ELECTRICAL WORK, INTERIOR for additional lighting installation requirements.

#### 3.1.1.2 Splayed Hangers

Where hangers must be splayed (sloped or slanted) around obstructions, the resulting horizontal force shall be offset by bracing, counter splaying, or other acceptable means.

### 3.1.2 Wall Molding

Wall molding shall be provided where ceilings abut vertical surfaces. Miter corners where wall moldings intersect or install corner caps. Wall molding shall be secured not more than 3 inches from ends of each length and not more than 16 inches on centers between end fastenings. Wall molding springs shall be provided at each acoustical unit in semi-exposed or concealed systems.

### 3.1.3 Acoustical Units

Acoustical units shall be installed in accordance with the approved installation instructions of the manufacturer. Edges of acoustical units shall be in close contact with metal supports, with each other, and in true alignment. Acoustical units shall be arranged so that units less than one-half width are minimized. Units in exposed-grid system shall be held in place with manufacturer's standard hold-down clips.

### 3.1.4 Adhesive Application

Wipe back of tile to remove accumulated dust. Daub acoustical units on back side with four equal daubs of adhesive. Apply daubs near corners of tiles. Contact area of each daub shall be at least 2 inches diameter in final position. Press units into place, aligning joints and abutting units tight and uniform without differences in joint widths.

## 3.2 CEILING ACCESS PANELS

Ceiling access panels shall be located directly under the items which require access.

## 3.3 CLEANING

Following installation, dirty or discolored surfaces of acoustical units

shall be cleaned and left free from defects. Units that are damaged or improperly installed shall be removed and new units provided as directed.

#### 3.4 RECLAMATION PROCEDURES

Ceiling tile, designated for recycling by the Contracting Officer, shall be neatly stacked on 4 by 4 foot pallets not higher than 4 foot. Panels shall be completely dry. Pallets shall then be shrink wrapped and symmetrically stacked on top of each other without falling over. Disposal shall be in accordance with Section 01572 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT.

-- End of Section --

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SECTION 09650

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08/02

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## SECTION 09650

## RESILIENT FLOORING

08/02

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 4078	(1992; R 1996) Water Emulsion Floor Polish
ASTM E 648	(2000) Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
ASTM E 662	(2001) Specific Optical Density of Smoke Generated by Solid Materials
ASTM F 1066	(1999) Vinyl Composition Floor Tile
ASTM F 1913	(1998) Vinyl Sheet Floor Covering Without Backing

## 1.2 FIRE RESISTANCE REQUIREMENTS

Flooring in corridors and exits shall have a minimum average critical radiant flux of 0.45 watts per square centimeter when tested in accordance with ASTM E 648. The smoke density rating shall be less than 450 when tested in accordance with ASTM E 662.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Sheet Flooring; G-AO  
Tile Flooring; G-AO

Drawings indicating location of seams, integral cove, including details of outside corner and cap, and edge strips.

## SD-03 Product Data

Tile Flooring; G-DO

Sheet Flooring; G-DO  
Accessories for Sheet Vinyl; G-DO  
Integral Coved Base; G-DO  
Adhesive for Sheet Vinyl; G-AO  
Adhesive for Vinyl Composition Tile; G-AO  
Adhesive for Wall Base; G-AO

Manufacturer's descriptive data and installation instructions including cleaning and maintenance instructions.

#### SD-04 Samples

Tile Flooring; G-DO  
Sheet Flooring; G-DO  
Weld Rod; G-DO  
Wall Base; G-DO  
Sheet Vinyl Cap Strip; G-DO  
Transition Strip; G-DO

Three samples of each indicated color and type of flooring and base. Sample size shall be minimum 2-1/2 x 4 inches.

#### SD-06 Test Reports

Moisture Test; G-AO

Copies of test reports showing that representative product samples of the flooring proposed for use have been tested by an independent testing laboratory within the past three years or when formulation change occurred and conforms to the requirements specified.

#### SD-08 Manufacturer's Instructions

Sheet Flooring; G-AO  
Tile Flooring; G-AO

Copies of flooring manufacturer's recommended installation procedures.

#### SD-10 Operation and Maintenance Data

Data Package 1; G-AO

Data Package in accordance with Section 01781 OPERATION AND MAINTENANCE DATA.

### 1.4 DELIVERY AND STORAGE

Materials shall be delivered to the building site in original unopened containers bearing the manufacturer's name, brands, stock names, production run, project identification, and handling instructions. Materials shall be stored in a clean dry area with temperature maintained above 70 degrees F for 2 days prior to installation, and shall be stacked according to manufacturer's recommendations. Materials shall be protected from the direct flow of heat from hot-air registers, radiators and other heating fixtures and appliances. Do not open containers until materials are to be used, except for inspection to verify compliance with requirements.

### 1.5 ENVIRONMENTAL REQUIREMENTS

- a. Areas to receive resilient flooring shall be maintained at a temperature above 70 degrees F and below 100 degrees F for 2 days before application, during application and 2 days after application. A minimum temperature of 55 degrees F shall be maintained thereafter.
- b. Provide adequate ventilation to remove moisture from area and to comply with regulations limiting concentrations of hazardous vapors.

### 1.6 SCHEDULING

Resilient flooring application shall be scheduled after the completion of other work which would damage the finished surface of the flooring.

### 1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided.

### 1.8 EXTRA MATERIALS

Extra flooring material of each color and pattern shall be furnished at the rate of 5 tiles for each 100 tiles and 5 square feet for each 1000 square feet of sheet flooring installed. Extra materials shall be from the same lot as those installed. Extra base material composed of 20 linear feet of each color shall be furnished. All extra materials shall be packaged in original containers, properly marked.

## PART 2 PRODUCTS

### 2.1 TILE FLOORING

#### 2.1.1 Vinyl-Composition Tile

Vinyl composition tile shall conform to ASTM F 1066, Class 2, (through pattern tile), Composition 1, asbestos-free, and shall be 12 inches square and 1/8 inch thick. Tile shall have the color and pattern uniformly distributed throughout the thickness of the tile. Flooring in any one continuous area shall be from the same lot and shall have the same shade and pattern.

#### 2.1.2 Adhesive for Vinyl Composition Tile

Adhesive shall be as recommended by the flooring manufacturer.

### 2.2 SHEET FLOORING

#### 2.2.1 Sheet Vinyl Flooring

Sheet vinyl flooring shall be composed of a homogeneous, vinyl composition formulated without asbestos. Flooring shall be not less than 72 inches wide. High quality welding rods for heat welding of joints shall be provided.

##### 2.2.1.1 Style A; Heat-Sealed, Rolls

Sheet vinyl flooring without backing shall meet the composition, flexibility, indentation, and the solvent resistance requirements of ASTM F

1913. The solid vinyl color and pattern shall extend through the total thickness of the material.

- a. Thickness: Overall thickness 0.080 inch; wear layer shall be a single layer with through pattern only, not embossed.
- b. Pattern: Mottled or flecked.

#### 2.2.1.2 Weld Rod

Provide weld rod of same material as sheet vinyl flooring and as recommended by flooring manufacturer in conjunction with Style A sheet vinyl flooring. Color will be as specified in Section 09915 Color Schedule.

#### 2.2.2 Integral Coved Base

A vinyl or rubber round cap strip and vinyl, rubber, or wood fillet strip with a minimum radius of 3/4 inch shall be provided for integral coved bases at perimeter and fixed vertical interruptions to flooring. Integral cove shall be of the same material as flooring.

##### 2.2.2.1 Integral Cove Trim

Provide inside and outside corner guards. Corner guards shall be as recommended by the flooring manufacturer.

##### 2.2.2.2 Fillet for Integral Cove

Fillet strip shall be as recommended by flooring manufacturer.

#### 2.2.3 Adhesive for Sheet Vinyl and Integral Cove Base

Adhesive for flooring and integral cove base shall be as recommended by the flooring manufacturer.

#### 2.2.4 Accessories for Sheet Vinyl

##### 2.2.4.1 Primer for Concrete Floor Surfaces

As recommended by flooring manufacturer.

##### 2.2.4.2 Floor Crack Filler

Nonshrinking latex portland cement-based compound, as recommended by flooring manufacturer.

##### 2.2.4.3 Mastic Underlay for Concrete Floor Surfaces

Latex or polyvinyl acetate resin base, as recommended by flooring manufacturer.

#### 2.3 STRIPS

##### 2.3.1 Transition

A vinyl or rubber transition strip tapered to meet abutting material shall be provided.

#### 2.4 BASE

#### 2.4.1 Wall Base

Base shall be manufacturers standard rubber or vinyl, straight style (installed with carpet) and coved style (installed with resilient flooring). Base shall be 4 inches high and a minimum 1/8 inch thick. Job formed corners shall be furnished. Color shall be as specified in Section 09915 Color Schedule.

#### 2.4.2 Adhesive for Wall Base

Adhesive for wall base shall be as recommended by base manufacturer.

#### 2.5 POLISH/FINISH

Polish shall conform to ASTM D 4078.

#### 2.6 CAULKING AND SEALANTS

Caulking and sealants shall be in accordance with Section 07900A JOINT SEALING.

#### 2.7 MANUFACTURER'S COLOR AND TEXTURE

Color and pattern shall be uniformly distributed throughout thickness of tile. Color and texture shall be in accordance with Section 09915 COLOR SCHEDULE. Flooring in continuous area or replacement of damaged flooring in continuous area shall be from same production run with same shade and pattern,

### PART 3 EXECUTION

#### 3.1 EXAMINATION/VERIFICATION OF CONDITIONS

The Contractor shall examine and verify that site conditions are in agreement with the design package and shall report all conditions that will prevent a proper installation. The Contractor shall not take any corrective action without written permission from the Government.

#### 3.2 SURFACE PREPARATION

Flooring shall be in a smooth, true, level plane, except where indicated as sloped. Before any work under this section is begun, all defects such as rough or scaling concrete, low spots, high spots, trowel marks, pits, dents, protrusions, and uneven surfaces shall have been corrected, and all damaged portions of concrete slabs shall have been repaired as recommended by the flooring manufacturer. Concrete curing compounds, other than the type that does not adversely affect adhesion, shall be entirely removed from the slabs. Paint, varnish, oils, release agents, sealers, waxers, and adhesives shall be removed, as recommended by the flooring manufacturer.

##### 3.2.1 Concrete Floor

Grind ridges and other uneven surfaces smooth. Cut out and fill cracks 1/16 inch or wider with crack filler. Provide mastic underlayment to fill remaining holes, cracks, and depressions and for smoothing, leveling, or creating a feather edge in accordance with instructions of mastic manufacturer. After cleaning and removal of loose particles, prime chalky or dusty surfaces with primer recommended by flooring manufacturer.

### 3.2.2 Final Cleaning of Substrate

Clean substrate with broom or vacuum immediately prior to the installation of flooring.

### 3.3 MOISTURE TEST

The suitability of the concrete subfloor for receiving the resilient flooring with regard to moisture content shall be determined by a moisture test as recommended by the flooring manufacturer.

### 3.4 GENERAL APPLICATION REQUIREMENTS

To avoid damage, install flooring after other work in same area has been completed. Apply flooring and accessories in accordance with manufacturer's directions, using experienced workers. Detailed requirements follow:

- a. Adhesives: Do not allow smoking, open flames or other sources of ignition in area where solvent-containing adhesives are being used or spread, after posting conspicuous signs reading "NO SMOKING OR OPEN FLAME".
- b. Flooring: Apply in patterns indicated. See drawings and Section 09915 Color Schedule for pattern information. Start in center of room or area, and work toward edges. Keep tile lines and joints square, symmetrical, tight, and even. Keep each floor in true, level plane, except where slope is indicated. Vary width of edge tiles as necessary to maintain full-size tiles in field, but no edge tile shall be less than one-half full size, except where irregular-shape makes it impossible.
- c. Cutting: Cut flooring edges and scribe to walls and partitions after field flooring has been applied.
- d. Edge Strips: Provide edging strips where flooring terminates at points higher than contiguous finished flooring, except where thresholds are provided. Secure plastic strips with adhesive.

### 3.5 INSTALLATION OF VINYL-COMPOSITION TILE AND SOLID VINYL TILE

Tile flooring shall be installed with adhesive in accordance with the manufacturer's installation instructions. Tile lines and joints shall be kept square, symmetrical, tight, and even. Edge width shall vary as necessary to maintain full-size tiles in the field, but no edge tile shall be less than one-half the field tile size, except where irregular shaped rooms make it impossible. Flooring shall be cut to, and fitted around, all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Edge tile shall be cut, fitted, and scribed to walls and partitions after field flooring has been applied.

### 3.6 INSTALLATION OF SHEET VINYL FLOORING AND INTEGRAL COVERED BASE

Sheet vinyl flooring shall be installed with adhesive mixed and applied in accordance with the manufacturer's written installation instructions; adhesive shall be full coverage. Flooring shall be fitted to the room with minimum of seams by hand cutting or straight scribing as necessary to suit job conditions. Flooring shall be cut to, and fitted around, all permanent

fixtures, built-in furniture and cabinets, pipes, and outlets. Reverse rolls, as indicated by manufacturer, for specific patterns, to butt sides to themselves, and match color and pattern. Seams shall be cut by overlapping or underscribing as recommended by the manufacturer. Seams and edges of sheet vinyl flooring shall be welded as recommended by the manufacturer. Flooring shall be installed with an integral coved base.

### 3.6.1 Heat Weld Seaming

Provide heat-sealed seaming with weld rod at each joint in flooring and between flooring and integral base. Construct seams using tools, materials, methods, and sequence of work in conformance with written instructions of flooring manufacturer. Finish joints flush, free from voids, recesses, and raised areas.

### 3.7 INSTALLATION OF WALL BASE

Wall base shall be installed with adhesive in accordance with the manufacturer's written instructions. Base joints shall be tight and base shall be even with adjacent resilient flooring. Voids along the top edge of base at masonry walls shall be filled with caulk. Where wall base is used in conjunction with vinyl wall covering, cut vinyl wall covering off 1/4 inch below top of base. Roll entire vertical surface of base with hand roller, and press toe of base with a straight piece of wood to ensure proper alignment. Avoid excess adhesive in corners.

### 3.8 INSTALLATION OF INTEGRAL COVED BASE

Integral coved base shall be formed by extending the flooring material 4 inches onto the wall surface. Cove shall be supported by a coved filler having a minimum radius of 3/4 inch. Coved base shall be installed with adhesive in accordance with the manufacturer's written instructions. A cap strip shall be provided at the top of the base. Voids along the top edge of base at masonry walls shall be filled with caulk.

### 3.9 CLEANING

Immediately upon completion of installation of tile in a room or an area, flooring and adjacent surfaces shall be dry-cleaned to remove all surplus adhesive. No sooner than 5 days after installation, flooring shall be washed with a nonalkaline cleaning solution, rinsed thoroughly with clear cold water, and given two coats of polish in accordance with manufacturers written instructions.

- a. Vinyl flooring shall have two coats of polish applied and each coat buffed to an even luster with an electric polishing machine, using a lamb's wool pad when dry buffing.

### 3.10 PROTECTION

From the time of laying until acceptance, flooring shall be protected from damage as recommended by the flooring manufacturer. Flooring which becomes damaged, loose, broken, or curled and cove base which is not tight to backing fillet shall be removed and replaced.

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SECTION 09680A

CARPET

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## SECTION 09680A

CARPET  
05/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

- AATCC 16 (1998) Test Method: Colorfastness to Light
- AATCC 134 (1996) Test Method: Electrostatic Propensity of Carpets
- AATCC 165 (1999) Test Method: Colorfastness to Crocking: Carpets - AATCC Crockmeter Method

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM D 418 (1993; R 1997) Pile Yarn Floor Covering Construction
- ASTM D 3278 (1996e1) Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus
- ASTM E 648 (2000) Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

## CARPET AND RUG INSTITUTE (CRI)

- CRI 104 (1996) Commercial Carpet Installation Standard

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

- 16 CFR 1630 Standard for the Surface Flammability of Carpet and Rugs (FF 1-70)
- 40 CFR 247 Comprehensive Procurement Guideline for Products Containing Recovered Materials

## GERMANY INSTITUTE FOR STANDARDIZATION (DIN)

- DIN 54318 (1986) Machine-Made Textile Floor Coverings; Determination of Dimensional Changes Due to the Effects of Varied Water and Heat Conditions; Identical with ISO

2551 Edition 1981

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Installation; G-AO  
Molding; G-AO

Three copies of drawings indicating areas receiving carpet, carpet types, textures and patterns, direction of pile, location of seams, and locations of edge molding.

## SD-03 Product Data

Carpet; G-DO

Manufacturer's catalog data and printed documentation stating physical characteristics, durability, resistance to fading, and flame resistance characteristics for each type of carpet material and installation accessory.

Surface Preparation; G-AO  
Installation; G-AO

Three copies of the manufacturer's printed installation instructions for the carpet, including preparation of substrate, seaming techniques, and recommended adhesives and tapes.

## SD-04 Samples

Carpet; G-DO  
Molding; G-DO

a. Carpet: Three "Production Quality" samples 18 x 18 inches of each carpet proposed for use, showing quality, pattern, and color specified.

b. Vinyl Moldings: Three pieces of each type at least 12 inches long.

c. Special Treatment Materials: Three samples showing system and installation method.

## SD-06 Test Reports

Moisture and Alkalinity Tests; G-AO

Three copies of test reports of moisture and alkalinity content of concrete slab stating date of test, person conducting the test, and the area tested.

## SD-07 Certificates

### Carpet

Certificates of compliance from a laboratory accredited by the National Laboratory Accreditation Program of the National Institute of Standards and Technology attesting that each type of carpet and carpet with cushion material conforms to the standards specified.

#### Regulatory Requirements; G-DO

Three copies of report stating that carpet contains recycled materials and/or involvement in a recycling or reuse program. Report shall include percentage of recycled material.

#### SD-10 Operation and Maintenance Data

##### Carpet Cleaning and Protection

Three copies of carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting and cleaning methods, and cleaning cycles.

### 1.3 REGULATORY REQUIREMENTS

Carpet and adhesives shall bear the Carpet and Rug Institute (CRI) Indoor Air Quality (IAQ) label or demonstrate compliance with testing criteria and frequencies through independent laboratory test results. Carpet type bearing the label will indicate that the carpet has been tested and meets the criteria of the CRI IAQ Carpet Testing Program, and minimizes the impact on indoor air quality. Contractor shall procure carpet in accordance with 40 CFR 247. Carpet shall conform to EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS. Where possible, product shall be purchased locally to reduce emissions of fossil fuels from transporting.

### 1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in the manufacturer's original wrappings and packages clearly labeled with the manufacturer's name, brand name, size, dye lot number, and related information. Materials shall be stored in a clean, dry, well ventilated area, protected from damage and soiling, and shall be maintained at a temperature above 60 degrees F for 2 days prior to installation.

### 1.5 ENVIRONMENTAL REQUIREMENTS

Areas in which carpeting is to be installed shall be maintained at a temperature above 60 degrees F for 2 days before installation, during installation, and for 2 days after installation. A minimum temperature of 55 degrees F shall be maintained thereafter for the duration of the contract. Traffic or movement of furniture or equipment in carpeted area shall not be permitted for 24 hours after installation. Other work which would damage the carpet shall be completed prior to installation of carpet.

### 1.6 WARRANTY

Manufacturer's standard performance guarantees or warranties including

minimum ten (10) year wear warranty, two (2) year material and workmanship and ten (10) year tuft bind and delamination.

#### 1.7 EXTRA MATERIAL

Extra material from same dye lot consisting of full width continuous broadloom and uncut carpet tiles shall be provided for future maintenance. A minimum of 5 percent of total square yards of each carpet type, pattern, and color shall be provided.

### PART 2 PRODUCTS

#### 2.1 CARPET TYPE

Carpet shall be first quality; free of visual blemishes, streaks, poorly dyed areas, fuzzing of pile yarn, spots or stains, and other physical and manufacturing defects. Carpet materials and treatments shall be reasonably nonallergenic and free of other recognized health hazards. All grade carpets shall have a static control construction which gives adequate durability and performance.

##### 2.1.1 Physical Characteristics **CPT-1**

Carpet shall comply with the following:

- a. Recycle Efforts: Use of nylon fiber with recycled content 25 per cent (minimum).
- b. Carpet Construction: Tufted.
- c. Type: Broadloom 12 feet minimum usable carpet width.
- d. Pile Type: Level-loop or Multilevel-loop.
- e. Pile Fiber: Commercial 100% branded (federally registered trademark) nylon continuous filament.
- f. Pile or Wire Height: Minimum .187 inch in accordance with ASTM D 418.
- g. Gauge or Pitch: Minimum 1/10 inch in accordance with ASTM D 418.
- h. Stitches or Rows/Wires: Minimum 9 per square inch.
- i. Finished Pile Yarn Weight: Minimum 28 ounces per square yard. This does not include weight of backings. Weight shall be determined in accordance with ASTM D 418.
- j. Pile Density: Minimum 5300.
- k. Dye Method: Solution dyed, yarn (or skein) dyed, or a blend of the two.
- l. Backing Materials: Primary backing materials shall be those customarily used and accepted by the trade for each type of carpet. Secondary backing to suit project requirements shall be those customarily used and accepted by the trade for each type of carpet, except when a special unitary back designed for gluedown is provided.

### 2.1.2 Physical Characteristics **CPT-2**

Carpet shall comply with the following:

- a. Recycle Efforts: Use of nylon carpet with backing containing recovered carpet or use of nylon fiber with recycled content 25 per cent (minimum).
- b. Carpet Construction: Tufted.
- c. Type: Modular tile 18 x 18 inches square with 0.15 percent growth/shrink rate in accordance with DIN 54318.
- d. Pile Type: Multilevel loop.
- e. Pile Fiber: Commercial 100% branded (federally registered trademark) nylon continuous filament.
- f. Pile or Wire Height: Minimum .117 inch in accordance with ASTM D 418.
- g. Gauge or Pitch: Minimum 1/13 inch in accordance with ASTM D 418.
- h. Stitches or Rows/Wires: Minimum 8.5 per square inch.
- i. Finished Pile Yarn Weight: Minimum 20 ounces per square yard. This does not include weight of backings. Weight shall be determined in accordance with ASTM D 418.
- j. Pile Density: Minimum 7100.
- k. Dye Method: Solution dyed, yarn (or skein) dyed, or a blend of the two.
- l. Backing Materials: Primary backing materials shall be synthetic material. Secondary backing shall be synthetic material.

### 2.1.3 Physical Characteristics **CPT-3**

Carpet shall comply with the following:

- a. Recycle Efforts: Use of nylon carpet with backing containing recovered carpet or use of nylon fiber with recycled content 25 per cent (minimum).
- b. Carpet Construction: Tufted.
- c. Type: Modular tile 18 x 18 inches square with 0.15 percent growth/shrink rate in accordance with DIN 54318.
- d. Pile Type: Multilevel loop.
- e. Pile Fiber: Commercial 100% branded (federally registered trademark) nylon continuous filament.
- f. Pile or Wire Height: Minimum .117 inch in accordance with ASTM D 418.

- g. Gauge or Pitch: Minimum 1/13 inch in accordance with ASTM D 418.
- h. Stitches or Rows/Wires: Minimum 8.6 per square inch.
- i. Finished Pile Yarn Weight: Minimum 17 ounces per square yard. This does not include weight of backings. Weight shall be determined in accordance with ASTM D 418.
- j. Pile Density: Minimum 6442.
- k. Dye Method: Solution dyed, yarn (or skein) dyed, or a blend of the two.
- l. Backing Materials: Primary backing materials shall be synthetic material. Secondary backing shall be synthetic material.

#### 2.1.4 Physical Characteristics **CPT-4**

Carpet shall comply with the following:

- a. Recycle Efforts: Use of nylon carpet with backing containing recovered carpet or use of nylon fiber with recycled content 25 per cent (minimum).
- b. Carpet Construction: Tufted.
- c. Type: Modular tile 18 x 18 inches square with 0.15 percent growth/shrink rate in accordance with DIN 54318.
- d. Pile Type: Multilevel or patterned loop.
- e. Pile Fiber: Commercial 100% branded (federally registered trademark) nylon continuous filament.
- f. Pile or Wire Height: Minimum .187 inch in accordance with ASTM D 418.
- g. Gauge or Pitch: Minimum 1/13 inch in accordance with ASTM D 418.
- h. Stitches or Rows/Wires: Minimum 9.8 per square inch.
- i. Finished Pile Yarn Weight: Minimum 22 ounces per square yard. This does not include weight of backings. Weight shall be determined in accordance with ASTM D 418.
- j. Pile Density: Minimum 7200.
- k. Dye Method: Solution dyed, yarn (or skein) dyed, or a blend of the two.
- l. Backing Materials: Primary backing materials shall be synthetic material. Secondary backing shall be synthetic material.

#### 2.1.5 Physical Characteristics **Entry Carpet**

Carpet shall comply with the following:

- a. Description: Heavy-duty entry carpet has abbrasive texture.

- b. Carpet Construction: Tufted (Nylon) or Needle-punched (Polypropylene).
- c. Type: Modular tile 18 x 18 inches square or 6 foot broadloom.
- d. Pile Type: High-low textured loop.
- e. Pile Fiber: Yarn dyed commercial 100% branded (federally registered trademark) nylon continuous filament with soil protection and a monofilament fiber for extra abrasiveness -or- solution dyed 100% Polypropylene.
- f. Pile or Wire Height: Minimum .217 inch in accordance with ASTM D 418.
- g. Finished Pile Yarn Weight: Minimum 38 ounces per square yard for nylon -or- minimum 50 ounces per square yard for Polypropylene. This does not include weight of backings. Weight shall be determined in accordance with ASTM D 418.
- h. Backing Materials: Backing materials shall be those customarily used and accepted by the trade for entry carpet.

#### 2.1.6 Performance Requirements

- b. Static Control: Static control shall be provided to permanently control static buildup to less than 3.5 kV when tested at 20 percent relative humidity and 70 degrees F in accordance with AATCC 134.
- c. Flammability and Critical Radiant Flux Requirements: Carpet shall comply with 16 CFR 1630. Carpet in corridors and exits shall have a minimum average critical radiant flux of 0.45 watts per square centimeter when tested in accordance with ASTM E 648.
- d. Tuft Bind: Tuft bind force required to pull a tuft or loop free from carpet backing shall be a minimum 10 pound average force for loop pile.
- e. Colorfastness to Crocking: Dry and wet crocking shall comply with AATCC 165 and shall have a Class 4 minimum rating on the AATCC Color Transference Chart for all colors.
- f. Colorfastness to Light: Colorfastness to light shall comply with AATCC 16, Test Option E "Water-Cooled Xenon-Arc Lamp, Continuous Light" and shall have a minimum 4 grey scale rating after 40 hours.
- g. Delamination Strength: Delamination strength for tufted carpet with a secondary back shall be minimum of 2.5 lbs./inch.

#### 2.2 ADHESIVES AND CONCRETE PRIMER

Adhesives and concrete primers for installation of carpet shall be waterproof, nonflammable, meet local air-quality standards, and shall be as required by the carpet manufacturer. Seam adhesive shall be waterproof, nonflammable, and nonstaining as recommended by the carpet manufacturer. Release adhesive for modular tile carpet shall be as recommended by the carpet manufacturer. Adhesives flashpoint shall be minimum 140 degrees F

in accordance with ASTM D 3278.

### 2.3 MOLDING

Vinyl molding shall be heavy-duty and designed for the type of carpet being installed. Floor flange shall be a minimum 2 inches wide. Color shall be as specified in Section 09915 Color Schedule.

### 2.4 TAPE

Tape for seams shall be as recommended by the carpet manufacturer for the type of seam used in installation.

### 2.5 COLOR, TEXTURE, AND PATTERN

Color, texture, and pattern shall be in accordance with Section 09915 COLOR SCHEDULE.

## PART 3 EXECUTION

### 3.1 SURFACE PREPARATION

Carpet shall not be installed on surfaces that are unsuitable and will prevent a proper installation. Holes, cracks, depressions, or rough areas shall be repaired using material recommended by the carpet or adhesive manufacturer. Floor shall be free of any foreign materials and swept broom clean. Before beginning work, subfloor shall be tested with glue and carpet to determine "open time" and bond.

### 3.2 MOISTURE AND ALKALINITY TESTS

Concrete slab shall be tested for moisture content and excessive alkalinity in accordance with CRI 104.

### 3.3 PREPARATION OF CONCRETE SUBFLOOR

Installation of the carpeting shall not commence until concrete substrate is at least 90 days old. The concrete surfaces shall be prepared in accordance with instructions of the carpet manufacturer. Type of concrete sealer, when required, shall be compatible with the carpet.

### 3.4 INSTALLATION

All work shall be performed by installers who are CFI certified (International Certified Floorcovering Installer Association), or manufacturer's approved installers. Installation shall be in accordance with the manufacturer's instructions and CRI 104. Edges of carpet meeting hard surface flooring shall be protected with molding; installation shall be in accordance with the molding manufacturer's instructions.

#### 3.4.1 Broadloom Installation

Broadloom carpet shall be installed direct glue down and shall be smooth, uniform, and secure, with a minimum of seams. Seams shall be uniform, unnoticeable, and treated with a seam adhesive. Side seams shall be run toward the light where practical and where such layout does not increase the number of seams. Breadths shall be installed parallel, with carpet pile in the same direction. Patterns shall be accurately matched. Cutouts, as at door jambs, columns and ducts shall be neatly cut and fitted

securely. Seams at doorways shall be located parallel to and centered directly under doors. Seams shall not be made perpendicular to doors or at pivot points. Seams at changes in directions of corridors shall follow the wall line parallel to the carpet direction. Corridors with widths less than 6 feet shall have the carpet laid lengthwise down the corridors.

#### 3.4.2 Modular Tile Installation

Modular tiles shall be installed with release adhesive and shall be snugly jointed together. Tiles shall be laid in accordance with manufacturers recommendations.

#### 3.4.2 Entry Carpet Installation

Tiles shall be snugly jointed together and shall be laid in an alternating pattern. Roll goods installation shall be smooth, uniform, and have no seams due to the size of the area being covered. Entry carpet shall be installed in accordance with manufacturers recommendations and with adhesive as recommended by manufacturer. Cutouts, as at door jambs, columns and ducts shall be neatly cut and fitted securely. Seams at doorways shall be located parallel to and centered directly under doors.

### 3.5 CLEANING AND PROTECTION

#### 3.5.1 Cleaning

After installation of the carpet, debris, scraps, and other foreign matter shall be removed. Soiled spots and adhesive shall be removed from the face of the carpet with appropriate spot remover. Protruding face yarn shall be cut off and removed. Carpet shall be vacuumed clean.

#### 3.5.2 Protection

The installed carpet shall be protected from soiling and damage with heavy, reinforced, nonstaining kraft paper, plywood, or hardboard sheets. Edges of kraft paper protection shall be lapped and secured to provide a continuous cover. Traffic shall be restricted for at least 45 hours. Protective covering shall be removed when directed by the Contracting Officer.

### 3.6 REMNANTS

Remnants remaining from the installation, consisting of scrap pieces more than 2 feet in dimension with more than 6 square feet total, shall be provided. Non-retained scraps shall be removed from site and recycled appropriately.

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WALLCOVERINGS

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SECTION 09720

WALLCOVERINGS

07/02

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 84 (2001) Surface Burning Characteristics of Building Materials

CHEMICAL FABRICS & FILM ASSOCIATION (CFFA)

CFFA-W-101-B (1995) Vinyl Coated Fabric Wallcovering

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Wallcoverings; G-DO

Manufacturer's descriptive data, documentation stating physical characteristics, flame resistance, mildew and germicidal characteristics.

Installation; G-AO

Preprinted installation instructions for wallcovering and accessories.

Maintenance  
Clean-Up

Preprinted cleaning and maintenance instructions for wallcovering and accessories.

SD-04 Samples

Wallcoverings; G-DO

Three samples of each indicated type, pattern, and color of

wallcovering. Samples of wall covering shall be minimum 5 x 7 inches and of sufficient size to show pattern repeat. Three samples of each indicated type corner guard.

#### SD-07 Certificates

##### Wallcoverings

Manufacturer's statement attesting that the product furnished meets or exceeds specification requirements. The statement must; be dated after the award of the contract, state Contractor's name and address, name the project and location, and list the requirements being certified.

#### SD-08 Manufacturer's Instructions

##### Wallcoverings

Submit complete procedures for an expert installation, including preparation of the substrate. Submit Material Safety Data Sheets (MSDS) for all primers, sealers, and adhesives to the Contracting Officer.

#### SD-10 Operation and Maintenance Data

##### Wallcoverings, Data Package 1; G-AO

Submit operation and maintenance data in accordance with Section 01781 OPERATION AND MAINTENANCE DATA.

### 1.3 DELIVERY AND STORAGE

Deliver the material to the site in manufacturer's original wrappings and packages and clearly labeled with the manufacturer's name, brand name, size, and other related information. Store in a safe, dry, clean, and well-ventilated area at temperatures not less than 50 degrees F and within a relative humidity range of 30 to 60 percent. Store wall covering material in a flat position and protect from damage, soiling, and moisture. Do not open containers until needed for installation, unless verification inspection is required.

### 1.4 ENVIRONMENTAL REQUIREMENTS

Minimum temperature of area to receive wall covering, before, during, and after installation, and requirements for conditioning adhesive and wall covering shall comply with the wall covering manufacturer's printed instructions. However, in no case shall the area temperature be less than 50 degrees F, 72 hours prior to, during installation, and until the adhesive is dry. Observe ventilation and safety procedures specified in the MSDS.

### 1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one-year period shall be provided.

### 1.6 EXTRA MATERIALS

Provide one linear foot of full-width wall covering of each pattern and

color for each 20 linear feet of wall covering installed. Extra stock shall be of the same manufacture, type, pattern, color, and lot number as the installed wall covering. Provide full rolls, packed for storage and marked with content, pattern, and color. Leave extra stock at the site at a location as directed by Contracting Officer.

## PART 2 PRODUCTS

### 2.1 WALLCOVERINGS

Wallcoverings shall be material designed specifically for the specified use. The wallcovering shall contain a non-mercury based mildewcide. The wallcovering shall be type made without the use of cadmium based stabilizers. Wallcovering shall have a Class A flame spread rating of 0-25 and smoke development rating of 0-50 when tested in accordance with ASTM E 84.

#### 2.1.1 Wallcovering

Vinyl wall covering shall be Type II (Medium Duty - 13 to 21 ounces/sq yd.) in accordance with CFFA-W-101-B. Width of wallcovering shall be 52/54 inches.

### 2.2 CORNER GUARDS

Corner guards shall be 3/32 inch thick and shall cover 3/4 inch each side of corner at right angles. Corner guards shall be clear and from the same lot and color.

### 2.3 PRIMER AND ADHESIVE

Primer and adhesive shall be of a type recommended by the wallcovering manufacturer and shall contain a non-mercury based mildewcide. When substrate color variations show through vinyl wallcovering, a white pigmented primer as recommended by the wallcovering manufacturer shall be used to conceal the variations. Adhesive shall be strippable type.

### 2.4 COLOR, TEXTURE, AND PATTERN

Color, texture, and pattern shall be in accordance with Section 09915 COLOR SCHEDULE.

## PART 3 EXECUTION

### 3.1 EXAMINATION

Contractor shall inspect all areas and conditions under which wallcoverings are to be installed. Contractor shall notify in writing of any conditions detrimental to the proper and timely completion of the installation. Work will proceed only when conditions have been corrected and accepted by the installer.

### 3.2 SURFACE PREPARATION

Wallcovering shall not be applied to surfaces that are rough, that contain stains that will bleed through the wallcovering, or that are otherwise unsuitable for proper installation. Cracks and holes shall be filled and rough spots shall be sanded smooth. Surfaces to receive wallcovering shall be thoroughly dry. Interior surfaces of new and existing gypsum wallboard

shall be primed with a wallcovering primer in accordance with the manufacturer's instructions. As required, white primer shall be used when substrate color variations are visible through thin or light color wallcovering. Interior surfaces of exterior masonry walls shall be sealed to prevent moisture penetration, then primed with a wallcovering primer in accordance with the manufacturer's instructions. Moisture content of plaster, concrete, and masonry shall be tested with an electric moisture meter and reading shall be not more than 5 percent. Surface of walls shall be primed as required by manufacturer's instructions to permit ultimate removal of wallcovering from the wall surface. Primer shall be allowed to completely dry before adhesive application.

### 3.3 INSTALLATION

#### 3.3.1 Vinyl Wallcovering

Wallcovering shall be installed in accordance with the manufacturer's installation instructions. Glue and adhesive spillage shall be immediately removed from wallcovering face and seams with a remover recommended by the manufacturer.

#### 3.3.2 Corner Guards

Corner guards shall be installed on all exposed corners on walls with vinyl wallcovering and in accordance with the manufacturer's printed instructions. Corner guards shall run from top of base to ceiling in a continuous length.

### 3.4 CLEAN-UP

Upon completion of the work, wallcovering shall be left clean and free of dirt, soiling, stain, or residual film. Surplus materials, rubbish, and debris resulting from the wallcovering installation shall be removed and area shall be left clean.

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## SECTION 09900

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## PAINTS AND COATINGS

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## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH Limit Values (1991-1992) Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)

ACGIH TLV-DOC Documentation of Threshold Limit Values and Biological Exposure Indices

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A13.1 Scheme for Identification of Piping Systems

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 235 Standard Specification for Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)

ASTM D 523 (1999) Standard Test Method for Specular Gloss

ASTM C 669 (1995) Glazing Compounds for Back Bedding and Face Glazing of Metal Sash

ASTM C 920 (1998) Elastomeric Joint Sealants

ASTM D 2092 (1995) Preparation of Zinc-Coated (Galvanized) Steel Surfaces for Painting

ASTM D 2824 (1994) Aluminum-Pigmented Asphalt Roof Coatings, Non-Fibered, Asbestos Fibered, and Fibered Without Asbestos

ASTM D 4214 (1998) Evaluating the Degree of Chalking of Exterior Paint Films

ASTM D 4263 (1983; R 1999) Indicating Moisture in Concrete by the Plastic Sheet Method

ASTM D 4444 (1998) Standard Test Methods for Use and Calibration of Hand-Held Moisture Meters

ASTM F 1869 (1998) Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.1000 Air Contaminants  
29 CFR 1910.1001 Asbestos, Tremolite, Anthophyllite, and Actinolite  
29 CFR 1910.1025 Lead  
29 CFR 1926.62 Lead Exposure in Construction

FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 70/7460-1 (Rev J) Obstruction Marking and Lighting

FEDERAL STANDARDS (FED-STD)

FED-STD-313 (Rev. C) Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities

FED-STD-595 (1989 Rev B) Color

MASTER PAINTERS INSTITUTE (MPI)

MPI 1 (2001) Aluminum Paint  
MPI 2 (2001) Aluminum Heat Resistant Enamel (up to 427 C and 800 F)  
MPI 4 (2001) Interior/Exterior Latex Block Filler  
MPI 5 (2001) Exterior Alkyd Wood Primer  
MPI 6 (2001) Exterior Latex Wood Primer  
MPI 7 (2001) Exterior Oil Wood Primer  
MPI 8 (2001) Exterior Alkyd, Flat  
MPI 9 (2001) Exterior Alkyd Enamel  
MPI 10 (2001) Exterior Latex, Flat  
MPI 11 (2001) Exterior Latex, Semi-Gloss  
MPI 13 (2001) Exterior Semi-Transparent Stain (Solvent Based)  
MPI 16 (2001) Exterior Solid Color Latex Stain  
MPI 19 (2001) Inorganic Zinc Primer  
MPI 20 (2001) Epoxy Zinc Primer

MPI 21	(2001)Heat Resistant Enamel, Gloss, (Up to 205 C or 400 F)
MPI 22	(2001) High Heat Resistant Coating
MPI 23	(2001) Surface Tolerant Metal Primer
MPI 26	(2001) Cementitious Galvanized Metal Primer
MPI 27	(2001) Exterior / Interior Alkyd Floor Enamel, Gloss
MPI 31	(2001) Polyurethane, Moisture Cured, Clear Gloss
MPI 39	(2001) Interior Latex-based Wood Primer
MPI 42	(2001) Latex Stucco and Masonry Textured Coating
MPI 44	Interior Latex, Gloss Level 2
MPI 45	(2001) Interior Primer Sealer
MPI 46	(2001) Interior Enamel Undercoat
MPI 47	(2001) Interior Alkyd, Semi-Gloss
MPI 48	(2001) Interior Alkyd, Gloss
MPI 49	(2001) Interior Alkyd, Flat
MPI 50	(2001) Interior Latex Primer Sealer
MPI 51	(2001) Interior Alkyd, Eggshell
MPI 52	(2001) Interior Latex, Gloss Level 3
MPI 54	(2001) Interior Latex, Semi-Gloss
MPI 56	(2001) Interior Alkyd Dry Fog/Fall
MPI 57	(2001) Interior Oil Modified Clear Urethane, Satin
MPI 59	(2001) Interior/Exterior Alkyd Porch & Floor Enamel, Low Gloss
MPI 60	(2001) Interior/Exterior Latex Porch & Floor Paint, Low Gloss
MPI 68	(2001) Interior/Exterior Latex Porch & Floor Paint, Gloss
MPI 71	(2001) Polyurethane, Moisture Cured, Clear, Flat
MPI 72	(2001) Polyurethane, Two Component,

Pigmented, Gloss

MPI 77 (2001) Epoxy Cold Cured, Gloss

MPI 79 (2001) Marine Alkyd Metal Primer

MPI 90 (2001) Interior Wood Stain,  
Semi-Transparent

MPI 94 (2001) Exterior Alkyd, Semi-Gloss

MPI 95 (2001) Fast Drying Metal Primer

MPI 101 (2001) Cold Curing Epoxy Primer

MPI 104 (2001) Interior/Exterior Clear Concrete  
Floor Sealer (solvent based)

MPI 107 (2001) Rust Inhibitive Primer (Water-Based)

MPI 108 (2001) High Build Epoxy Marine Coating

MPI 110 (2001) Interior/Exterior High Performance  
Acrylic

MPI 113 (2001) Elastomeric Coating

MPI 116 (2001) Epoxy Block Filler

MPI 119 (2001) Exterior Latex, High Gloss (acrylic)

MPI 134 (2001) Waterborne Galvanized Primer

MPI 138 (2001) High Performance Latex, White and  
Tints - MPI Gloss Level 2

MPI 139 (2001) High Performance Latex, White and  
Tints - MPI Gloss Level 3

MPI 140 (2001) High Performance Architectural  
Latex - Gloss Level 4

MPI 141 (2001) High Performance Semigloss Latex,  
White and Tints - Gloss Level 5

MPI 144 (2001) Institutional Low Odor / VOC  
Interior Latex, Gloss Level 2

MPI 145 (2001) Institutional Low Odor / VOC  
Interior Latex, Gloss Level 3

MPI 146 Institutional Low Odor/VOC Interior Latex  
- Gloss Level 4 (a 'satin-like' finish)

MPI 147 (2001) Institutional Low Odor / VOC  
Interior Latex, Gloss Level 5

COMMERCIAL ITEM DESCRIPTION (CID)

CID A-A-2904 Thinner, Paint, Mineral Spirits, Regular and Odorless

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-101 (Rev. B) Color Code for Pipelines and for Compressed Gas Cylinders

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS-EPP-SP01-01 (2001) Environmentally Preferable Product Specification for Architectural and Anti-Corrosive Paints

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC Guide 6 (1997) Containing Debris Generated During Paint Removal Operations

SSPC Guide 7 (1995) Disposal of Lead-Contaminated Surface Preparation Debris

SSPC QP 1 (1989) Evaluating Qualifications of Painting Contractors (Field Application to Complex Structures)

SSPC PA 1 (2000) Shop, Field, and Maintenance Painting

SSPC PA 3 (1995) Safety in Paint Application

SSPC VIS 1 (1989) Visual Standard for Abrasive Blast Cleaned Steel (Standard Reference Photographs)

SSPC VIS 3 (1993) Visual Standard for Power- and Hand-Tool Cleaned Steel (Standard Reference Photographs)

SSPC VIS 4 (2001) Guide and Reference Photographs for Steel Surfaces Prepared by Waterjetting

SSPC SP 1 (1982) Solvent Cleaning

SSPC SP 2 (1995) Hand Tool Cleaning

SSPC SP 3 (1995) Power Tool Cleaning

SSPC SP 6 (1994) Commercial Blast Cleaning

SSPC SP 7 (1994) Brush-Off Blast Cleaning

SSPC SP 10 (1994) Near-White Blast Cleaning

SSPC SP 12 (1995) Surface Preparation and Cleaning of Steel and Other Hard Materials by High-and Ultra high-Pressure Water Jetting Prior to Recoating

SSPC Paint 18

(1991) Chlorinated Rubber Intermediate  
Coat Paint

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

The current MPI, "Approved Product List" which lists paint by brand, label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use a subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI Approved Products List is acceptable.

Samples of specified materials may be taken and tested for compliance with specification requirements.

In keeping with the intent of Executive Order 13101, "Greening the Government through Waste Prevention, Recycling, and Federal Acquisition", products certified by SCS as meeting SCS-EPP-SP01-01 shall be given preferential consideration over registered products. Products that are registered shall be given preferential consideration over products not carrying any EPP designation.

## SD-02 Shop Drawings

Piping identification; G-DO,

Submit color codes.

## SD-03 Product Data

Coating; G-DO,

Manufacturer's Technical Data Sheets; G-DO,

## SD-04 Samples

Color; G-DO

Submit manufacturer's samples of paint colors. Cross reference color samples to color scheme as indicated. Provide three samples of each color, minimum size 6" x 6".

## SD-07 Certificates

Applicator's qualifications;

Qualification Testing laboratory for coatings;

## SD-08 Manufacturer's Instructions

Application instructions;

Mixing;

Detailed mixing instructions, minimum and maximum application temperature and humidity, potlife, and curing and drying times between coats.

Manufacturer's Material Safety Data Sheets

Submit manufacturer's Material Safety Data Sheets for coatings, solvents, and other potentially hazardous materials, as defined in FED-STD-313.

SD-10 Operation and Maintenance Data

Coatings;

Preprinted cleaning and maintenance instructions for all coating systems shall be provided.

### 1.3 APPLICATOR'S QUALIFICATIONS

#### 1.3.1 Contractor Qualification

Submit the name, address, telephone number, FAX number, and e-mail address of the contractor that will be performing all surface preparation and coating application. Submit evidence that key personnel have successfully performed surface preparation and application of coatings on a minimum of three similar projects within the past three years. List information by individual and include the following:

- a. Name of individual and proposed position for this work.
- b. Information about each previous assignment including:

Position or responsibility

Employer (if other than the Contractor)

Name of facility owner

Mailing address, telephone number, and telex number (if non-US) of facility owner

Name of individual in facility owner's organization who can be contacted as a reference

Location, size and description of structure

Dates work was carried out

Description of work carried out on structure

#### 1.3.2 SSPC QP 1 Certification

All contractors and subcontractors that perform surface preparation or coating application shall be certified by the Society for Protective Coatings (formerly Steel Structures Painting Council) (SSPC) to the

requirements of SSPC QP 1 prior to contract award, and shall remain certified while accomplishing any surface preparation or coating application. The painting contractors and painting subcontractors must remain so certified for the duration of the project. If a contractor's or subcontractor's certification expires, the firm will not be allowed to perform any work until the certification is reissued. Requests for extension of time for any delay to the completion of the project due to an inactive certification will not be considered and liquidated damages will apply. Notify the Contracting Officer of any change in contractor certification status.

### 1.3.3 General Polymer Systems (Polyurea)

General Polymers painting systems shall be applied only by the manufacturer's approved contractors. Applicator Qualifications shall include the following:

1. Only factory trained and qualified applicator that has successfully completed applications using specified materials on projects of similar size and scope. Provide references with name, address, and telephone number.
2. Contractor shall have completed the manufacturer's certification program in the use of heated plural component equipment and the specified polyurea material. Provide written certification from the equipment manufacturer and material manufacturer. Contractor must own and maintain their own plural component equipment.

## 1.4 QUALITY ASSURANCE

### 1.4.1 Field Samples and Tests

The Contracting Officer may choose up to two coatings that have been delivered to the site to be tested at no cost to the Government. Take samples of each chosen product as specified in the paragraph "Sampling Procedures." Test each chosen product as specified in the paragraph "Testing Procedure." Products which do not conform, shall be removed from the job site and replaced with new products that conform to the referenced specification. Testing of replacement products that failed initial testing shall be at no cost to the Government.

#### 1.4.1.1 Sampling Procedure

The Contracting Officer will select paint at random from the products that have been delivered to the job site for sample testing. The Contractor shall provide one quart samples of the selected paint materials. The samples shall be taken in the presence of the Contracting Officer, and labeled, identifying each sample. Provide labels in accordance with the paragraph "Packaging, Labeling, and Storage" of this specification.

#### 1.4.1.2 Testing Procedure

Provide Batch Quality Conformance Testing for specified products, as defined by and performed by MPI. As an alternative to Batch Quality Conformance Testing, the Contractor may provide Qualification Testing for specified products above to the appropriate MPI product specification, using the third-party laboratory approved under the paragraph

"Qualification Testing" laboratory for coatings. The qualification testing lab report shall include the backup data and summary of the test results. The summary shall list all of the reference specification requirements and the result of each test. The summary shall clearly indicate whether the tested paint meets each test requirement. Note that Qualification Testing may take 4 to 6 weeks to perform, due to the extent of testing required.

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party laboratory selected to perform testing of coating samples for compliance with specification requirements. Submit documentation that laboratory is regularly engaged in testing of paint samples for conformance with specifications, and that employees performing testing are qualified. If the Contractor chooses MPI to perform the Batch Quality Conformance testing, the above submittal information is not required, only a letter is required from the Contractor stating that MPI will perform the testing.

## 1.5 REGULATORY REQUIREMENTS

### 1.5.1 Environmental Protection

In addition to requirements specified elsewhere for environmental protection, provide coating materials that conform to the restrictions of the local Air Pollution Control District and regional jurisdiction. Notify Contracting Officer of any paint specified herein which fails to conform.

### 1.5.2 Lead Content

Do not use coatings having a lead content over 0.06 percent by weight of nonvolatile content.

### 1.5.3 Chromate Content

Do not use coatings containing zinc-chromate or strontium-chromate throughout the project.

### 1.5.4 Asbestos Content

Materials shall not contain asbestos.

### 1.5.5 Mercury Content

Materials shall not contain mercury or mercury compounds.

### 1.5.6 Silica

Abrasive blast media shall not contain free crystalline silica.

### 1.5.7 Human Carcinogens

Materials shall not contain ACGIH Limit Values and ACGIH TLV-DOC confirmed human carcinogens (A1) or suspected human carcinogens (A2).

## 1.6 PACKAGING, LABELING, AND STORAGE

Paints shall be in sealed containers that legibly show the contract specification number, designation name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and

special precautions, and name and address of manufacturer. Pigmented paints shall be furnished in containers not larger than 5 gallons. Paints and thinners shall be stored in accordance with the manufacturer's written directions, and as a minimum, stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors, and at temperatures between 40 to 95 degrees F.

#### 1.7 SAFETY AND HEALTH

Apply coating materials using safety methods and equipment in accordance with the following:

Work shall comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis as specified in Section 01525, "Safety Requirements" and in Appendix A of EM 385-1-1. The Activity Hazard Analysis shall include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

##### 1.7.1 Safety Methods Used During Coating Application

Comply with the requirements of SSPC PA 3.

##### 1.7.2 Toxic Materials

To protect personnel from over exposure to toxic materials, conform to the most stringent guidance of:

- a. The applicable manufacturer's Material Safety Data Sheets (MSDS) or local regulation.
- b. 29 CFR 1910.1000.
- c. ACGIH Limit Values, threshold limit values.

#### 1.8 ENVIRONMENTAL CONDITIONS

##### 1.8.1 Coatings

Do not apply coating when air or substrate conditions are:

- a. Less than 5 degrees F above dew point;
- b. Below 50 degrees F or over 95 degrees F, unless specifically pre-approved by the Contracting Officer and the product manufacturer. Under no circumstances shall application conditions exceed manufacturer recommendations.

#### 1.9 COLOR SELECTION

Colors of finish coats shall be as indicated or specified. Where not indicated or specified, colors shall be selected by the Contracting Officer. Manufacturers' names and color identification are used for the purpose of color identification only. Named products are acceptable for use only if they conform to specified requirements. Products of other manufacturers are acceptable if the colors approximate colors indicated and the product conforms to specified requirements.

Tint each coat progressively darker to enable confirmation of the number of

coats.

Color, texture, and pattern of wall coating systems shall be in accordance with Section 09915 COLOR SCHEDULE.

#### 1.10 LOCATION AND SURFACE TYPE TO BE PAINTED

##### 1.10.1 Painting Included

The term "paint" as used herein includes emulsions, enamels, paints, stains, varnishes, sealers, cement-emulsion fillers and other coatings, whether used as prime, intermediate, or finish coat. Where a space or surface is indicated to be painted, include the following unless indicated otherwise.

- a. Surfaces behind portable objects and surface mounted articles readily detachable by removal of fasteners, such as screws and bolts.
- b. New factory finished surfaces that require identification or color coding and/or factory finished surfaces that are damaged during performance of the work.
- c. Existing coated surfaces that are damaged during performance of the work.

##### 1.10.1.1 Exterior Painting

Includes new surfaces, existing coated surfaces damaged during construction, exterior building signage and appurtenances as indicated. Also included are existing coated surfaces made bare by cleaning operations.

##### 1.10.1.2 Interior Painting

Includes new surfaces and appurtenances as indicated and existing coated surfaces made bare by cleaning operations. Painting shall include exposed surfaces in the following areas, but shall not be limited to the following:

- a. Exposed columns, girders, beams, joists, and metal decks (roof and mezzanine).
- b. Other contiguous surfaces.
- c. All exposed gypsum wallboard and concrete masonry surfaces.
- d. All exposed wood surfaces
- e. Cabinetry and millwork items.
- f. All exposed areas and equipment throughout the facility, without a factory finish.
- g. Doors, door and window frames.
- h. Utilities, HVAC ducts, conduit, wiring and other facility support systems.
- i. Concrete floors- where specified.

### 1.10.2 Painting Excluded

Do not paint the following unless indicated otherwise.

- a. Surfaces concealed and made inaccessible by panelboards, fixed ductwork, machinery, and equipment fixed in place.
- b. Surfaces in concealed spaces. Concealed spaces are defined as enclosed spaces above suspended ceilings, furred spaces, attic spaces, crawl spaces, and chases.
- c. Steel to be embedded in concrete.
- d. Copper, stainless steel, aluminum, brass, and lead except existing coated surfaces.
- e. Hardware, fittings, and other factory finished items.
- f. Concrete floors, except where specified.
- g. Fire protection sprinkler heads.

### 1.10.3 Mechanical and Electrical Painting

Includes field coating of interior and exterior new surfaces.

- a. Where a space or surface is indicated to be painted, include the following items unless indicated otherwise.
  - (1) Exposed piping, conduit, and ductwork;
  - (2) Supports, hangers, air grilles, and registers;
  - (3) Miscellaneous metalwork and insulation coverings.
- b. Do not paint the following, unless indicated otherwise:
  - (1) New zinc-coated, aluminum, and copper surfaces under insulation
  - (2) New aluminum jacket on piping
  - (3) New interior ferrous piping under insulation.
  - (4) Plastic piping.

#### 1.10.3.1 Fire Extinguishing Sprinkler Systems

Clean, pretreat, prime, and paint new fire extinguishing sprinkler systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories. Apply coatings to clean, dry surfaces, using clean brushes. Clean the surfaces to remove dust, dirt, rust, and loose mill scale. Immediately after cleaning, provide the metal surfaces with one coat primer per schedules. Shield sprinkler heads with protective covering while painting is in progress. Upon completion of painting, remove protective covering from sprinkler heads. Remove sprinkler heads which have been painted and replace with new sprinkler heads.

- a. Water storage and processing tanks areas: See Section 09965A for

painting requirements regarding interior and exterior water storage and processing tanks.

#### 1.10.4 Exterior Painting of Site Work Items

Field coat the following items:

##### New Surfaces

- a. Exposed steel columns,
- b. All exterior signage- where specified,
- c. All exposed surfaces of the roof canopy (framing, decking, utilities),
- d. Plates and other items utilized to support the roof canopy,
- e. All exposed utility conduits,
- f. All exterior hollow metal doors, hollow metal door frames, louvers and other exposed surfaces,
- g. Roofing gutters, downspouts and supports,
- h. Roofing metal soffits (if prefinished metal finish does not match roofing)

#### 1.10.5 PIPE COLOR BANDING

##### Piping Color Banding Requirements

WATER USE	DESIGNATION	COLOR
Raw Water	RW	Green
Cold/Treated Water	CTW	Blue
Pre-Heated/Treated Water	PHTW	Blue - Double Stripe
Heated/Treated Water	HTW	Red
Used Process Water	UPW	Brown
Waste Water	WW	Gray
Re-Used Process Water	RPW	Tan
Energy Recovery Water	ERW	Orange
Drain Line	DL	Black
Incubation Air	IA	Yellow
Heating Water Supply (Boiler)	HWS	Burnt Orange
Heating Water Return (Boiler)	HWR	Pink
Chemical Feed	CF	Purple

Lettering shall be block type, and shall be water-type decalcomania, finished with a protective coating of spar varnish. Lettering shall have a double color banding on each side of the lettering. Banding shall be a minimum of 3/4 inches in width. Piping designations shall be provided at all exposed piping throughout the hatchery at a maximum of 15 linear feet. Samples shall be approved before application.

### 1.10.6 Definitions and Abbreviations

#### 1.10.6.1 Qualification Testing

Qualification testing is the performance of all test requirements listed in the product specification. This testing is accomplished by MPI to qualify each product for the MPI Approved Product List, and may also be accomplished by Contractor's third party testing lab if an alternative to Batch Quality Conformance Testing by MPI is desired.

#### 1.10.6.2 Batch Quality Conformance Testing

Batch quality conformance testing determines that the product provided is the same as the product qualified to the appropriate product specification. This testing shall only be accomplished by MPI testing lab.

#### 1.10.6.3 Coating

A film or thin layer applied to a base material called a substrate. A coating may be a metal, alloy, paint, or solid/liquid suspensions on various substrates (metals, plastics, wood, paper, leather, cloth, etc.). They may be applied by electrolysis, vapor deposition, vacuum, or mechanical means such as brushing, spraying, calendaring, and roller coating. A coating may be applied for aesthetic or protective purposes or both. The term "coating" as used herein includes emulsions, enamels, stains, varnishes, sealers, epoxies, and other coatings, whether used as primer, intermediate, or finish coat. The terms paint and coating are used interchangeably.

#### 1.10.6.4 DFT or dft

Dry film thickness, the film thickness of the fully cured, dry paint or coating.

#### 1.10.6.5 DSD

Degree of Surface Degradation, the MPI system of defining degree of surface degradation. Five (5) levels are generically defined under the Assessment sections in the MPI Maintenance Repainting Manual.

#### 1.10.6.6 EPP

Environmentally Preferred Products, a standard for determining environmental preferability in support of Executive Order 13101.

#### 1.10.6.7 EXT

MPI short term designation for an exterior coating system.

#### 1.10.6.8 INT

MPI short term designation for an interior coating system.

#### 1.10.6.9 micron / microns

The metric measurement for 0.001 mm or one/one-thousandth of a millimeter.

#### 1.10.6.10 mil / mils

The English measurement for 0.001 in or one/one-thousandth of an inch, equal to 25.4 microns or 0.0254 mm.

#### 1.10.6.11 mm

The metric measurement for millimeter, 0.001 meter or one/one-thousandth of a meter.

#### 1.10.6.12 MPI Gloss Levels

MPI system of defining gloss. Seven (7) gloss levels (G1 to G7) are generically defined under the Evaluation sections of the MPI Manuals. Traditionally, Flat refers to G1/G2, Eggshell refers to G3, Semigloss refers to G5, and Gloss refers to G6.

Gloss levels are defined by MPI as follows:

Gloss Level	Description	Units @ 60 degrees	Units @ 85 degrees
G1	Matte or Flat	0 to 5	10 max
G2	Velvet	0 to 10	10 to 35
G3	Eggshell	10 to 25	10 to 35
G4	Satin	20 to 35	35 min
G5	Semi-Gloss	35 to 70	
G6	Gloss	70 to 85	
G7	High Gloss		

Gloss is tested in accordance with ASTM D 523. Historically, the Government has used Flat (G1 / G2), Eggshell (G3), Semi-Gloss (G5), and Gloss (G6).

#### 1.10.6.13 MPI System Number

The MPI coating system number in each Division found in either the MPI Architectural Painting Specification Manual or the Maintenance Repainting Manual and defined as an exterior (EXT/REX) or interior system (INT/RIN). The Division number follows the CSI Master Format.

#### 1.10.6.14 Paint

See Coating definition.

#### 1.10.6.15 REX

MPI short term designation for an exterior coating system used in repainting projects or over existing coating systems.

#### 1.10.6.16 RIN

MPI short term designation for an interior coating system used in repainting projects or over existing coating systems.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Conform to the coating specifications and standards referenced in PART 3.

Submit manufacturer's technical data sheets for specified coatings and solvents.

## 2.2 General Polymer Painting Systems (Polyurea)

Surface preparation shall be in accordance with manufacturer's recommendations. Concrete, concrete masonry unit walls, and gypsum wallboard surfaces identified for a polymer polyurea painting system shall include the following surface preparations:

1. Concrete surfaces shall be degreased as necessary using high-pressure water and biodegradable detergents. Rinse thoroughly.
2. Remove all existing coatings and linings by best (acceptable) method available. Only well-bonded coatings and linings may remain. Consult manufacturer.
3. Remove all laitance, contamination, curing compounds, by shot blasting, grit blasting, or other method approved by manufacturer to achieve a profile equal to 80 - 100 grit sandpaper.
4. Surface must be clean, sound, and dry prior to application.
5. Refer to ICRI Guide 03732 and NACE No. 6 / SSPC-SP 13.
6. Key-in all termination points not in "natural" termination points in accordance with manufacturer's details.
7. Prime with the appropriate primer system, following manufacturer's recommendations and coverage rates, taking care not to allow primer to puddle or fill the achieved anchor profile. Steel substrates may not require priming unless marginal conditions exist.
8. Fill all bug-holes with the appropriate filler, following manufacturer's recommendations and detail drawings. Press material firmly into all voids.
9. Seal perimeter and at all inside corners at changes in plane (i.e., wall/slab intersections) in accordance with manufacturer's detail drawings.
10. Additional requirements regarding concrete flooring areas to receive a sealer application are specified herein.

All gypsum wall board surfaces identified to receive a general polymer painting system (Polyurea) finish coating shall have a primer applied. Primer shall be a Sherwin-Williams, system #3504 or approved equal. Primer shall be a minimum 3 mil dry thickness.

Finish Polyurea paint system coating shall be a Sherwin-Williams, paint system Envirolastic AR 425 or approved equal. Paint system shall have the following properties:

PROPERTY	TEST METHOD	RESULTS
Tensile Elongation	ASTM D-638	425%
Tensile Strength	ASTM D-638	2750 psi
Tear Strength	ASTM D-624	450 pli
Shore D Hardness	ASTM D-2240	47
100% Modulus	ASTM D-638	1150 psi
300% Modulus	ASTM D-638	1730 psi
Flash Point of components (closed cup)		

## 2.3 Concrete Sealer

Concrete floor surfaces shall be prepared in accordance with manufacturer's recommendations. Concrete mix for areas identified to receive a sealer shall not include any hardeners, sealers or other membrane curing agents to

concrete. Moisture curing of concrete or the use of sodium silicate-based curing compounds is recommended. Concrete must be structurally sound and free of all voids and delaminations. Refer to SECTION: 03300 for repair procedures and manufacturer's recommendations. Cracks in excess of 1/16" shall be routed and sealed in accordance with manufacturer's recommended details.

A concrete primer sealer shall be applied over the proper prepared concrete floor. Concrete floor shall receive an acid etch finish in accordance with ASTM D 4260 (Practice For Acid Etching Concrete). Properly prepared concrete floors shall resemble a medium grid sandpaper (80-100 grid sandpaper). Concrete sealer primer shall be a solvent based sealer type MPI 104.

### PART 3 EXECUTION

#### 3.1 PROTECTION OF AREAS AND SPACES NOT TO BE PAINTED

Prior to surface preparation and coating applications, remove, mask, or otherwise protect, hardware, hardware accessories, machined surfaces, radiator covers, plates, lighting fixtures, public and private property, and other such items not to be coated that are in contact with surfaces to be coated. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Restore surfaces contaminated by coating materials, to original condition and repair damaged items.

#### 3.2 SURFACE PREPARATION

Remove dirt, splinters, loose particles, grease, oil, and other foreign matter and substances deleterious to coating performance as specified for each substrate before application of paint or surface treatments. Oil and grease shall be removed prior to mechanical cleaning. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, shall be spot-primed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

##### 3.2.1 Additional Requirements for Preparation of Surfaces With Existing Coatings

Before application of coatings, perform the following on surfaces covered by soundly-adhered coatings, defined as those which cannot be removed with a putty knife:

- a. Wipe previously painted surfaces to receive solvent-based coatings, except stucco and similarly rough surfaces clean with a clean, dry cloth saturated with mineral spirits, ASTM D 235. Allow surface to dry. Wiping shall immediately precede the application of the first coat of any coating, unless specified otherwise.
- b. Sand existing glossy surfaces to be painted to reduce gloss. Brush, and wipe clean with a damp cloth to remove dust.
- c. The requirements specified are minimum. Comply also with the application instructions of the paint manufacturer.

- d. Previously painted surfaces specified to be repainted and/or damaged during construction shall be thoroughly cleaned of all grease, dirt, dust or other foreign matter.
- e. Blistering, cracking, flaking and peeling or other deteriorated coatings shall be removed.
- f. Chalk shall be removed so that when tested in accordance with ASTM D 4214, the chalk resistance rating is no less than 8.
- g. Slick surfaces shall be roughened. Damaged areas such as, but not limited to, nail holes, cracks, chips, and spalls shall be repaired with suitable material to match adjacent undamaged areas.
- h. Edges of chipped paint shall be feather edged and sanded smooth.
- i. Rusty metal surfaces shall be cleaned as per SSPC requirements. Solvent, mechanical, or chemical cleaning methods shall be used to provide surfaces suitable for painting.
- j. New, proposed coatings shall be compatible with existing coatings.

### 3.2.2 Existing Coated Surfaces with Minor Defects

Sand, spackle, and treat minor defects to render them smooth. Minor defects are defined as scratches, nicks, cracks, gouges, spalls, alligatoring, chalking, and irregularities due to partial peeling of previous coatings.

### 3.2.3 Removal of Existing Coatings

Remove existing coatings from the following surfaces:

- a. Surfaces containing large areas of minor defects;
- b. Surfaces containing more than 20 percent peeling area; and
- c. Surfaces designated by the Contracting Officer, such as surfaces where rust shows through existing coatings.

### 3.2.4 Substrate Repair

- a. Repair substrate surface damaged during coating removal;
- b. Sand edges of adjacent soundly-adhered existing coatings so they are tapered as smooth as practical to areas involved with coating removal; and
- c. Clean and prime the substrate as specified.

## 3.3 PREPARATION OF METAL SURFACES

### 3.3.1 Existing and New Ferrous Surfaces

- a. Ferrous Surfaces including Shop-coated Surfaces and Small Areas That Contain Rust, Mill Scale and Other Foreign Substances: Solvent clean or detergent wash in accordance with SSPC SP 1 to remove oil and grease. Where shop coat is missing or damaged, clean according to SSPC SP 2, SSPC SP 3, SSPC SP 6, or SSPC SP 10.

Brush-off blast remaining surface in accordance with SSPC SP 7  
Shop-coated ferrous surfaces shall be protected from corrosion by  
treating and touching up corroded areas immediately upon detection.

- b. Surfaces With More Than 20 Percent Rust, Mill Scale, and Other Foreign Substances: Clean entire surface in accordance with SSPC SP 6/SSPC SP 12 WJ-3.

### 3.3.2 Final Ferrous Surface Condition:

For tool cleaned surfaces, the requirements are stated in SSPC SP 2 and SSPC SP 3. As a visual reference, cleaned surfaces shall be similar to photographs in SSPC VIS 3.

For abrasive blast cleaned surfaces, the requirements are stated in SSPC SP 7, SSPC SP 6, and SSPC SP 10. As a visual reference, cleaned surfaces shall be similar to photographs in SSPC VIS 1.

For waterjet cleaned surfaces, the requirements are stated in SSPC SP 12. As a visual reference, cleaned surfaces shall be similar to photographs in SSPC VIS 4.

### 3.3.3 Galvanized Surfaces

- a. New Galvanized Surfaces With Only Dirt and Zinc Oxidation Products: Clean with solvent, steam, or non-alkaline detergent solution in accordance with SSPC SP 1. If the galvanized metal has been passivated or stabilized, the coating shall be completely removed by brush-off abrasive blast. New galvanized steel to be coated shall not be "passivated" or "stabilized" If the absence of hexavalent stain inhibitors is not documented, test as described in ASTM D 2092, Appendix X2, and remove by one of the methods described therein.
- b. Galvanized with Slight Coating Deterioration or with Little or No Rusting: Water jetting to SSPC SP 12 WJ3 to remove loose coating from surfaces with less than 20 percent coating deterioration and no blistering, peeling, or cracking. Use inhibitor as recommended by the coating manufacturer to prevent rusting.

### 3.3.4 Non-Ferrous Metallic Surfaces

Aluminum and aluminum-alloy, lead, copper, and other nonferrous metal surfaces.

- a. Surface Cleaning: Solvent clean in accordance with SSPC SP 1 and wash with mild non-alkaline detergent to remove dirt and water soluble contaminants.

### 3.3.5 Terne-Coated Metal Surfaces

Solvent clean surfaces with mineral spirits, ASTM D 235. Wipe dry with clean, dry cloths.

### 3.3.6 Existing Surfaces with a Bituminous or Mastic-Type Coating

Remove chalk, mildew, and other loose material by washing with a solution of 1/2 cup trisodium phosphate, 1/4 cup household detergent, one quart 5 percent sodium hypochlorite solution and 3 quarts of warm water.

### 3.4 PREPARATION OF CONCRETE AND CEMENTITIOUS SURFACE

#### 3.4.1 Concrete and Masonry

- a. Curing: Concrete and masonry surfaces shall be allowed to cure at least 30 days before painting, except concrete slab on grade, which shall be allowed to cure 90 days before painting.
- b. Surface Cleaning: Remove the following deleterious substances.

(1) Dirt, Chalking, Grease, and Oil: Wash new surfaces with a solution composed of 1/2 cup trisodium phosphate, 1/4 cup household detergent, and 4 quarts of warm water. Then rinse thoroughly with fresh water. For large areas, water blasting may be used.

(2) Fungus and Mold: Wash new, existing coated, and existing uncoated surfaces with a solution composed of 1/2 cup trisodium phosphate, 1/4 cup household detergent, 1 quart 5 percent sodium hypochlorite solution and 3 quarts of warm water. Rinse thoroughly with fresh water.

(3) Paint and Loose Particles: Remove by wire brushing.

(4) Efflorescence: Remove by scraping or wire brushing followed by washing with a 5 to 10 percent by weight aqueous solution of hydrochloric (muriatic) acid. Do not allow acid to remain on the surface for more than five minutes before rinsing with fresh water. Do not acid clean more than 4 square feet of surface, per workman, at one time.

Cosmetic Repair of Minor Defects: Repair or fill mortar joints and minor defects, including but not limited to spalls, in accordance with manufacturer's recommendations and prior to coating application.

- c. Allowable Moisture Content: Latex coatings may be applied to damp surfaces, but not to surfaces with droplets of water. Do not apply epoxies to damp vertical surfaces as determined by ASTM D 4263 or horizontal surfaces that exceed 3 lbs of moisture per 1000 square feet in 24 hours as determined by ASTM F 1869. In all cases follow manufacturers recommendations. Allow surfaces to cure a minimum of 30 days before painting.

#### 3.4.2 Gypsum Board

- a. Surface Cleaning: Gypsum board surfaces shall be clean, dry, and free from loose matter. Remove loose dirt and dust by brushing with a soft brush, rubbing with a dry cloth, or vacuum-cleaning prior to application of the first coat material. A damp cloth or sponge may be used if paint will be water-based.
- b. Repair of Minor Defects: Prior to painting, repair joints, cracks, holes, surface irregularities, and other minor defects with patching plaster or spackling compound and sand smooth.
- c. Allowable Moisture Content: Latex coatings may be applied to damp surfaces, but not surfaces with droplets of water. Do not apply epoxies to damp surfaces as determined by ASTM D 4263.

### 3.5 PREPARATION OF WOOD SURFACES

### 3.5.1 New Wood Surfaces:

- a. Wood surfaces shall be cleaned of foreign matter.

Surface Cleaning: Surfaces shall be free from dust and other deleterious substances and in a condition approved by the Contracting Officer prior to receiving paint or other finish. Do not use water to clean uncoated wood.

- b. Moisture content of the wood shall not exceed 12 percent as measured by a moisture meter in accordance with ASTM D 4444, Method A, unless otherwise authorized.
- c. Wood surfaces adjacent to surfaces to receive water-thinned paints shall be primed and/or touched up before applying water-thinned paints.
- d. Cracks and Nailheads: Set and putty stop nailheads and putty cracks after the prime coat has dried.
- e. Cosmetic Repair of Minor Defects:
- (1) Knots and Resinous Wood: Prior to application of coating, cover knots and stains with two or more coats of 3-pound-cut shellac varnish, plasticized with 5 ounces of castor oil per gallon. Scrape away existing coatings from knotty areas, and sand before treating. Prime before applying any putty over shellacked area.
  - (2) Open Joints and Other Openings: Fill with whiting putty, linseed oil putty. Sand smooth after putty has dried.
  - (3) Checking: Where checking of the wood is present, sand the surface, wipe and apply a coat of pigmented orange shellac. Allow to dry before paint is applied.
- f. Prime Coat For New Exterior Surfaces: Prime coat wood doors, windows, frames, and trim before wood becomes dirty, warped, or weathered.

### 3.5.2 Interior Wood Surfaces, Stain Finish

Interior wood surfaces to receive stain shall be sanded. Oak and other open-grain wood to receive stain shall be given a coat of wood filler not less than 8 hours before the application of stain; excess filler shall be removed and the surface sanded smooth.

## 3.6 APPLICATION

### 3.6.1 Coating Application

Painting practices shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards. Apply coating materials in accordance with SSPC PA 1. SSPC PA 1 methods are applicable to all substrates, except as modified herein.

At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application.

Unless otherwise specified or recommended by the paint manufacturer, paint

may be applied by brush, roller, or spray. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated.

Paints, except water-thinned types, shall be applied only to surfaces that are completely free of moisture as determined by sight or touch.

Thoroughly work coating materials into joints, crevices, and open spaces. Special attention shall be given to insure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces.

Each coat of paint shall be applied so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete.

Touch up damaged coatings before applying subsequent coats. Interior areas shall be broom clean and dust free before and during the application of coating material.

Apply paint to new fire extinguishing sprinkler systems including valves, water and drainage piping, conduit, hangers, supports, miscellaneous metal work, and accessories. Shield sprinkler heads with protective coverings while painting is in progress. Remove sprinkler heads which have been painted and replace with new sprinkler heads. For piping in unfinished spaces, provide primed surfaces with one coat of red alkyd gloss enamel to a minimum dry film thickness of 1.0 mil. Unfinished spaces include attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and space where walls or ceiling are not painted or not constructed of a prefinished material. For piping in finished areas, provide prime surfaces with two coats of paint to match adjacent surfaces, except provide valves and operating accessories with one coat of red alkyd gloss enamel. Upon completion of painting, remove protective covering from sprinkler heads.

- a. Drying Time: Allow time between coats, as recommended by the coating manufacturer, to permit thorough drying, but not to present topcoat adhesion problems. Provide each coat in specified condition to receive next coat.
- b. Primers, and Intermediate Coats: Do not allow primers or intermediate coats to dry more than 30 days, or longer than recommended by manufacturer, before applying subsequent coats. Follow manufacturer's recommendations for surface preparation if primers or intermediate coats are allowed to dry longer than recommended by manufacturers of subsequent coatings. Each coat shall cover surface of preceding coat or surface completely, and there shall be a visually perceptible difference in shades of successive coats.
- c. Finished Surfaces: Provide finished surfaces free from runs, drops, ridges, waves, laps, brush marks, and variations in colors.
- d. Thermosetting Paints: Topcoats over thermosetting paints (epoxies and urethanes) should be applied within the overcoating window recommended by the manufacturer.

### 3.6.2 Mixing and Thinning of Paints

Reduce paints to proper consistency by adding fresh paint, except when thinning is mandatory to suit surface, temperature, weather conditions, application methods, or for the type of paint being used. Obtain written permission from the Contracting Officer to use thinners. The written permission shall include quantities and types of thinners to use.

When thinning is allowed, paints shall be thinned immediately prior to application with not more than 1 pint of suitable thinner per gallon. The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed limits on volatile organic compounds. Paints of different manufacturers shall not be mixed.

### 3.6.3 Two-Component Systems

Two-component systems shall be mixed in accordance with manufacturer's instructions. Any thinning of the first coat to ensure proper penetration and sealing shall be as recommended by the manufacturer for each type of substrate.

### 3.6.4 Coating Systems

- a. Systems by Substrates: Apply coatings that conform to the respective specifications listed in the following Tables:

#### Table

#### Exterior

Division 5. Exterior Metal, Ferrous and Non-Ferrous Paint Table  
Division 9: Exterior E.I.F.S. Paint Table

#### Interior

Division 3. Interior Concrete Paint Table  
Division 4. Interior Concrete Masonry Units Paint Table  
Division 5. Interior Metal, Ferrous and Non-Ferrous Paint Table  
Division 6. Interior Wood Paint Table  
Division 9: Interior Gypsum Board Surfaces  
Paint Table

- b. Minimum Dry Film Thickness (DFT): Apply paints, primers, varnishes, enamels, undercoats, and other coatings to a minimum dry film thickness of 1.5 mil each coat unless specified otherwise in the Tables. Coating thickness where specified, refers to the minimum dry film thickness.
- c. Coatings for Surfaces Not Specified Otherwise: Coat surfaces which have not been specified, the same as surfaces having similar conditions of exposure.
- d. Existing Surfaces Damaged During Performance of the Work, Including New Patches In Existing Surfaces: Coat surfaces with the following:
- (1) One coat of primer.
  - (2) One coat of undercoat or intermediate coat.

(3) One topcoat to match adjacent surfaces.

- e. Existing Coated Surfaces To Be Painted: Apply coatings conforming to the respective specifications listed in the Tables herein, except that pretreatments, sealers and fillers need not be provided on surfaces where existing coatings are soundly adhered and in good condition. Do not omit undercoats or primers.

### 3.7 COATING SYSTEMS FOR METAL

Apply coatings of Tables in Division 5 for Exterior and Interior.

- a. Apply specified ferrous metal primer on the same day that surface is cleaned, to surfaces that meet all specified surface preparation requirements at time of application.
- b. Inaccessible Surfaces: Prior to erection, use one coat of specified primer on metal surfaces that will be inaccessible after erection.
- c. Shop-primed Surfaces: Touch up exposed substrates and damaged coatings to protect from rusting prior to applying field primer.
- d. Surface Previously Coated with Epoxy or Urethane: Apply MPI 101, 1.5 mils DFT immediately prior to application of epoxy or urethane coatings.
- e. Pipes and Tubing: The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat, but shall be overcoated with the specified ferrous-metal primer prior to application of finish coats.
- f. Exposed Nails, Screws, Fasteners, and Miscellaneous Ferrous Surfaces. On surfaces to be coated with water thinned coatings, spot prime exposed nails and other ferrous metal with latex primer MPI 107.

### 3.8 COATING SYSTEMS FOR CONCRETE AND CEMENTITIOUS SUBSTRATES

Apply coatings of Tables in Division 3 and 4 Interior.

### 3.9 COATING SYSTEMS FOR WOOD

- a. Apply coatings of Tables in Division 6 for Interior.
- b. Apply stains in accordance with manufacturer's printed instructions.

### 3.10 PIPING IDENTIFICATION

See Section: 09965A for surface preparation for interior and exterior painting of interior water processing tanks and equipment. Pipes and identification requirements.

### 3.11 INSPECTION AND ACCEPTANCE

In addition to meeting previously specified requirements, demonstrate mobility of moving components, including swinging doors, cabinets, and

windows with operable sash, for inspection by the Contracting Officer. Perform this demonstration after appropriate curing and drying times of coatings have elapsed and prior to invoicing for final payment.

### 3.12 PAINT TABLES

All DFT's are minimum values.

#### 3.12.1 EXTERIOR PAINT TABLES

##### DIVISION 5: EXTERIOR METAL, FERROUS AND NON-FERROUS PAINT TABLE

##### STEEL / FERROUS SURFACES

A. New Steel that has been hand or power tool cleaned to SSPC SP 2 or SSPC SP 3

##### 1. Alkyd

New; MPI EXT 5.1Q-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 23	MPI 94	MPI 94
System DFT: 5.25 mils		

B. New Steel that has been blast-cleaned to SSPC SP 6:

##### 1. Alkyd

New; MPI EXT 5.1D-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 79	MPI 94	MPI 94
System DFT: 5.25 mils		

C. New steel blast cleaned to SSPC SP 10:

##### 1. Waterborne Light Industrial

MPI EXT 5.1R-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 101	MPI 108	MPI 110-G5
System DFT: 8.5 mils		

##### EXTERIOR GALVANIZED SURFACES

D. New Galvanized surfaces:

##### 1. Epoxy Primer / Waterborne Light Industrial Coating

MPI EXT 5.3K-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 101	MPI 110-G5	MPI 110-G5
System DFT: 5 mils		

##### EXTERIOR SURFACES, OTHER METALS (NON-FERROUS)

E. Aluminum, aluminum alloy and other miscellaneous non-ferrous metal items not otherwise specified except hot metal surfaces, roof surfaces, and new prefabricated equipment. Match surrounding finish:

##### 1. Waterborne Light Industrial Coating

MPI EXT 5.4G-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 95	MPI 110-G5	MPI 110-G5

## EXTERIOR SURFACES, OTHER METALS (NON-FERROUS)

System DFT: 5 mils

F. Surfaces adjacent to painted surfaces; Mechanical, Electrical, Fire extinguishing sprinkler systems including valves, conduit, hangers, supports, exposed copper piping, and miscellaneous metal items not otherwise specified. Match surrounding finish:

## 1. Waterborne Light Industrial Coating

MPI EXT 5.1C-G5(Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 79	MPI 110-G5	MPI 110-G5

System DFT: 5 mils

G. Hot metal surfaces, including smokestacks subject to temperatures up to 205 degrees C (400 degrees F):

## 1. Heat Resistant Enamel

MPI EXT 5.2A

Primer:	Intermediate:	Topcoat:
MPI 21	Surface preparation and number of coats per manufacturer's instructions.	

System DFT: Per Manufacturer

H. Ferrous metal subject to high temperature, up to 400 degrees C (750 degrees F):

## 1. Heat Resistant Aluminum Enamel

MPI EXT 5.2B (Aluminum Finish)

Primer:	Intermediate:	Topcoat:
MPI 2	Surface preparation and number of coats per manufacturer's instructions.	

System DFT: Per Manufacturer

DIVISION 9: EXTERIOR E.I.F.S. PAINT TABLE

A. New E.I.F.S. surfaces, acrylic-based elastomeric system:

## 1. Elastomeric Coating

New; MPI EXT 9.1C / Existing; MPI REX 9.1C

Primer:	Intermediate:	Topcoat:
N/A	MPI 113	MPI 113

System DFT: 16 mils

Primer as recommended by manufacturer. Topcoat: Surface preparation in accordance with manufacturer's instructions. A minimum of 2 top finish coats required.

NOTE: Apply sufficient coats of MPI 113 to achieve a minimum dry film thickness of 16 mils .

## 3.12.2 INTERIOR PAINT TABLES

## DIVISION 3: INTERIOR CONCRETE PAINT TABLE

A. Concrete Floor Sealer-

(Includes concrete flooring in both vehicle vestibule rooms (#141 & #152) and

## DIVISION 3: INTERIOR CONCRETE PAINT TABLE

the entire vehicle drive-through (approx. 170 ft x 18 ft.) in room #145 areas .)

## 1. Concrete Floor Sealer Coating

MPI INT

Filler:	Primer:	Intermediate:	Topcoat:
		MPI 104	MPI 104

Note: Surface preparation in accordance with manufacturer's recommendations.

DIVISION 4: INTERIOR CONCRETE MASONRY UNITS PAINT TABLE

## A. Concrete Masonry Units-

(Scope of work includes all exposed concrete masonry unit locations, except the vehicle vestibules (Rms. 141 & 152). Areas included in this scope of work include the fish production & vehicle bay areas- (Rms. 111, 112, 113, 142 thru 151 (except, does not include room 148), & 200.).

## 1. Epoxy / Polyurethane- Aliphatic Coating

MPI INT 4.2N-G5 (Semigloss)

Filler:	Primer:	Intermediate:	Topcoat:
MPI 116	N/A	MPI 77	MPI 72
System DFT: 12 mils			

Note:

Fill all holes in masonry surface

MPI 77 paint shall be a semi-gloss type and/or sanded per manufacturer's recommendations to allow adhesion of the final polyurethane coating.

## B. Concrete, Concrete Masonry Units, Insulated Metal Wall Panels, &amp; Gypsum Wall Board surfaces-

(Scope of work includes only wall surfaces in both vehicle vestibule room (Rms. 141 & 152) locations. Paint all wall surfaces up to 14 feet (above finish floor level) in rooms 141 & 152. Paint all other surfaces (walls & roof) above 14 feet (above finish floor) with an Epoxy / Polyurethane-Aliphatic coating as specified.

Additional scope of work includes all walls and floor surfaces in Chemical (Rm #148). Paint all ceiling surfaces in this room with an Epoxy / Polyurethane- Aliphatic coating as specified. Paint the concrete floor, concrete curbs, and wall surfaces with a polyurea coating.

Scope of work includes only the concrete floor surfaces in Chemical (Rm #112).

## 1. Polyurea Coating

See specifications for paint requirements.

Fill all holes in concrete and masonry surfaces.

System DFT: 40-60 mils

DIVISION 5: INTERIOR METAL, FERROUS AND NON-FERROUS PAINT TABLE

## INTERIOR STEEL / FERROUS SURFACES

A. Metal, Mechanical, Electrical, Fire extinguishing sprinkler systems, including valves, conduit, hangers, supports, Surfaces adjacent to painted surfaces (Match surrounding finish), exposed copper piping, and miscellaneous metal items not otherwise specified-

(Scope of work includes: administrative, kitchen, and sleeping areas. This scope of work does not include the fish production & vehicle bay areas)

## 1. High Performance Architectural Latex

MPI INT 5.1R-G3 (Eggshell)  
 Primer: Intermediate: Topcoat:  
 MPI 79 MPI 139 MPI 139  
 System DFT: 5 mils

B. Metal, Mechanical, Electrical, Fire extinguishing sprinkler systems including valves, supports, surfaces adjacent to painted surfaces (Match surrounding finish), metal roof decks, steel piping (not plastic piping), cast iron piping, structural framing members, mezzanine flooring decks (underside) and miscellaneous metal items not otherwise specified-

(Scope of work includes fish production & vehicle bay areas- (Rms. 111, 112, 113, 142 thru 151 & 200 thru 202). However, scope of work does not include: both vehicle vestibules (Rms. 141 & 152- below 14 ft. above finish floor and room #148 walls/floor), administrative, kitchen and sleeping areas)

## Epoxy / Polyurethane- Aliphatic

MPI INT 5.1L-G6 (Gloss)  
 Primer: Intermediate: Topcoat:  
 MPI 20 MPI 77 MPI 72  
 System DFT: 5.25 mils

Note: MPI 77 paint shall be a semi-gloss type and/or sanded to allow adhesion of the final polyurethane coating.

C. Miscellaneous non-ferrous metal items not otherwise specified. Match surrounding finish:

(Scope of work includes: administrative, kitchen, sleeping areas, and corridors)

## 1. High Performance Architectural Latex

MPI INT 5.4F-G3 (Eggshell)  
 Primer: Intermediate: Topcoat:  
 MPI 95 MPI 139 MPI 139  
 System DFT: 5 mils

D. Hot metal surfaces including smokestacks subject to temperatures up to 205 degrees C (400 degrees F):

## 1. Heat Resistant Enamel

MPI INT 5.2A  
 Primer: Intermediate: Topcoat:  
 MPI 21 Surface preparation and number of coats per  
 manufacturer's instructions.  
 System DFT: Per Manufacturer

E. Ferrous metal subject to high temperature, up to 400 degrees C (750

INTERIOR STEEL / FERROUS SURFACES  
degrees F):

1. Heat Resistant Aluminum Paint  
MPI INT 5.2B (Aluminum Finish)  
Primer: Intermediate: Topcoat:  
MPI 2 Surface preparation and number of coats per  
manufacturer's instructions.  
System DFT: Per Manufacturer

DIVISION 6: INTERIOR WOOD PAINT TABLE

A. New wood surfaces in toilets, restrooms, and  
other high humidity areas not otherwise specified:

1. Waterborne Light Industrial  
MPI INT 6.3P-G5 (Semigloss)  
Stain: Primer: Intermediate: Topcoat:  
MPI 90 MPI 71 MPI 71 MPI 71  
System DFT: 4.5 mils

B. New Wood Doors and other wood surfaces; Stained:

1. Stained, oil-modified polyurethane  
New; MPI INT 6.3E-G4  
Stain: Primer: Intermediate: Topcoat:  
MPI 90 MPI 57 MPI 57 MPI 57  
System DFT: 4 mils  
Note: Sand between all coats per manufacturers recommendations.

DIVISION 9: INTERIOR GYPSUM BOARD SURFACES PAINT TABLE

A. New Gypsum Wallboard Surfaces:  
(Scope of work includes: all administrative / work areas, assembly areas,  
vestibules, administrative storage rooms, break rooms, coat rooms,  
kitchen, sleeping areas (temporary employee), closets, labs, isolation, and  
corridors)

1. Latex  
  
New; MPI INT 9.2M-G4 (Satin)  
Primer: Intermediate: Topcoat:  
MPI 50 MPI 140 MPI 140  
System DFT: 4 mils

B. New Gypsum Wallboard Surfaces:  
(Scope of work includes: fish production and vehicle bay areas (Rms. 111,  
112, 113, 142 thru 151 & 200 thru 202. In addition, includes vehicle  
vestibule rooms 141 & 152), mechanical, electrical and communication rooms.

1. Epoxy / Polyurethane- Aliphatic  
New; MPI INT 9.2E-G6 (Gloss)  
Primer: Intermediate: Topcoat:  
MPI 50 MPI 77 MPI 72  
System DFT: 4 mils

Note:

DIVISION 9: INTERIOR GYPSUM BOARD SURFACES PAINT TABLE

MPI 77 paint shall be a semi-gloss type and/or sanded per manufacturer's recommendations to allow adhesion of the final polyurethane coating.

C. New Gypsum Wallboard Surfaces:

(Scope of work includes: restrooms / toilets, janitor closets, utility, and shower areas)

1. Waterborne Light Industrial Coating

New; MPI INT 9.2L-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 50	MPI 110-G5	MPI 110-G5

System DFT: 4 mils

-- End of Section --

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DIVISION 09 - FINISHES

SECTION 09915

COLOR SCHEDULE

**06/93**

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-- End of Section Table of Contents --

## SECTION 09915

COLOR SCHEDULE  
06/93

## PART 1 GENERAL

## 1.1 GENERAL

This section covers only the color of the exterior and interior materials and products that are exposed to view in the finished construction. The word "color" as used herein includes surface color and pattern. Requirements for quality and method of installation are covered in other appropriate sections of the specifications. Specific locations where the various materials are required are shown on the drawings. Items not designated for color in this section may be specified in other sections. When color is not designated for items, the Contractor shall propose a color for approval.

## PART 2 PRODUCTS

## 2.1 REFERENCE TO MANUFACTURER'S COLOR

Where color is shown as being specific to one manufacturer, an equivalent color by another manufacturer may be submitted for approval. Manufacturers and materials specified are not intended to limit the selection of equal colors from other manufacturers.

## 2.2 COLOR SCHEDULE

The color schedule lists the colors, patterns and textures required for exterior and interior finishes, including both factory applied and field applied colors.

## 2.2.1 Exterior Walls

Exterior wall colors shall apply to exterior wall surfaces including recesses at entrances and projecting vestibules. Conduit shall be painted to closely match the adjacent surface color. Wall color shall be provided to match the colors listed below.

- a. Cultured Stone (CS): Owens Corning, Stream Stone, Summer Standard CSV-2071.
- b. Mortar: Natural.
- c. Painted Steel Columns (PNT-4): Benjamin Moore 974.
- d. Metal Wall Panels, Hardware, and Associated Trim (MP-1): MBCI Wall System, Light Stone.
- e. Exterior Insulation and Finish System Detail Accent: Match roof in color.
- f. Exterior Insulation and Finish System: Match metal wall panels in

color.

- g. Precast Concrete (PC): Art Stone, 6-03 Acid Etch.
- h. Glass and Glazing: Reference Section 08810 Glass and Glazing for color.

### 2.2.2 Exterior Trim

Exterior trim shall be provided to match the colors listed below.

- a. Painted Metal Doors and Door Frames: Match roof in color, unless otherwise noted. The interior side of door number 131, shall match:
  - Door: (PNT-2) Benjamin Moore 469
  - Frame: (PNT-3) Benjamin Moore 1035
- b. Aluminum Doors and Door Frames: Match roof in color.
- c. Sectional Overhead Doors and Trim: Exterior side shall match roof in color. Interior side shall match adjacent wall and in color, including wall pattern where applicable. Reference drawing I2.01, typical painted CMU wall pattern.
- d. Aluminum Windows (mullion, muntin, sash, trim, and sill): Match roof in color.
- e. Guard Posts (Exterior and Interior): Match roof in color.
- f. Fascia, Louvers, Flashings, and Gutters: Match roof in color.
- g. Downspouts: Match the metal wall panel.
- h. Painted Handrails: Match roof in color.
- i. Overhangs, Soffits and Ceilings: Match the metal wall roof in color.
- j. Signage: .
  - Exterior Sign Type A:
    - ESGN-1:** Benjamin Moore 700; Main Signage Panel
    - ESGN-2:** Benjamin Moore 698; Raised Signage Panel
  - Panel Posts shall be a Dark Bronze Anodized Aluminum. Refer to drawings for additional information.
  - Reference Section 10430 Exterior Signage for colors of all other exterior signage types.
- k. Caulking and Sealants: Match adjacent material in color.
- l. Exposed Metal Deck and Structural Framing: Shall match the metal wall panel in color.

### 2.2.3 Exterior Roof

Roof color shall apply to exterior roof surfaces including sheet metal flashings and copings, mechanical units, roof trim, pipes, conduits, electrical appurtenances, and similar items. Roof color shall be provided to match the colors listed below.

- a. Metal (MP-2): MBCI Metal Roof System, Rustic Red

#### 2.2.4 Interior Floor Finishes

Flooring materials shall be provided to match the colors listed below.

- a. Carpet:
  - CPT-1:** Designweave, Harmonics, Hip Hop Z6317-00328; located in Rooms 124 and 128 Temporary Employee and Rooms 125 and 129 Closets.
- b. Carpet Tile:
  - CPT-2:** Collins & Aikmans, Synapse, 71011 Esprit; located in-Lounge Area of Rm 131 Temporary Employee Support. Reference drawing A1.04 and I2.01 for location.  
Corridor 127 and 133
  - CPT-3:** Collins & Aikmans, Neuron, 58011 Esprit(manufacturer requires product to be quarter turned); located in-  
110 Corridor  
116 Open Office Area  
118 Coat Room  
119 Work Area  
120 Storage  
121 Office  
122 Corridor  
123 Office
  - CPT-4:** Collins & Aikmans, Gridworks, 22007 Cassia Bark; located in 102 Public Meeting Room and 103 Storage
- c. Vinyl Composition Tile: Reference drawing I2.01 for floor patterns.
  - VCT-1:** Mannington, Designer Essentials, 255 Frosted Jade; accent VCT located in dining area of Rm 131 Temporary Employee Support.
  - VCT-2:** Mannington, Essentials, 107 Bisque; field VCT located in dining area of Rm 131 Temporary Employee Support, 105 Employee Break Area and 132 Janitor.
  - VCT-4:** Mannington, Essentials, 123 Wheat; accent VCT located in dining area of Rm 131 Temporary Employee Support.
- d. Sheet Vinyl (SV): Mannington, BioSpec, 15134. Weld rod shall match Mannington 415134 (Mannington's compatible camouflage weld rod for flooring 15134).
- e. Ceramic Floor Tile (CFT): Daltile, Keystone, Mottled Medium Brown D050; Shall be used in showers.
- f. Marble Thresholds: Bone or Beige.
- g. Porcelain Tile:
  - PT-1 (Accent Tile):** Crossville, VS104 Verde; accent tile Rm 101 Display; located in Rm 101 Display.
  - PT-2 (Accent Tile):** Crossville, VS102 Brown; accent tile Rm 101 Display; located in Rm 101 Display.
  - PT-3 (Field Tile):** Florida Tile, Ariostea/Geo Natura, 127A Britannia; shall be used unless otherwise noted.
  - PT-4:** Crossville, VS100 Almond; located in Toilets rooms 126 and 130

Reference drawing I2.01 for floor pattern.

- h. Grout:
  - GR-1:** C-Cure, #252 Tumbleweed; to be used with PT-1, PT-2, PT-3 and CFT.
  - GR-2:** C-Cure, #51 Sand; to used with PT-4

#### 2.2.5 Interior Base Finishes

Base materials shall be provided to match the colors listed below.

- a. Resilient Base and Transition Strips:
  - RB-1:** VPI, Pickle 69; shall be used unless otherwise noted
  - RB-2:** Johnsonite, 45 Sandalwood; shall be located in-
    - 124 Temporary Employee
    - 126 Toilet
    - 128 Temporary Employee
    - 130 Toilet
    - 131 Temporary Employee Support
    - 132 Janitor

Transition strips shall match the resilient base color used in a room.

- b. Porcelain Tile:
  - PT-3:** Florida Tile, Ariostea/Geo Natura, 127A Britannia; shall be used unless otherwise noted
  - PT-4:** Crossville, VS100 Almond; located in toilets rooms 126 and 130
- c. Grout:
  - GR-1:** C-Cure, #252 Tumbleweed; to be used with PT-3
  - GR-2:** C-Cure, #51 Sand; to used with PT-4
- d. Coved Sheet Vinyl (SV): Mannington, BioSpec, 15134
- e. Sheet Vinyl Cap Strips: Shall match RB-1 in color.
- f. Ceramic Tile (CT-1): Florida Tile, 2035 Almond

#### 2.2.6 Interior Wall Finishes

Interior wall color shall apply to the entire wall surface, including reveals, vertical furred spaces, grilles, diffusers, electrical and access panels, and piping and conduit adjacent to wall surfaces unless otherwise specified. Items not specified in other paragraphs shall be painted to match adjacent wall surface. Wall materials shall be provided to match the colors listed below.

- a. Paint:
  - PNT-1:** Benjamin Moore 1074; shall be used unless otherwise noted. Reference drawing I2.01 for location in room 113 Incubation and 145 Hatchery Area.
  - PNT-5:** Benjamin Moore 468;
    - Rm 131 Temporary Employee Support painted soffit at cabinets and walls. Reference drawing I2.01 for wall location.
    - Rm 105 Employee Break painted soffit at cabinets.
  - PNT-6:** Benjamin Moore 968; Wall pattern located in room and 145

Hatchery Area, reference drawing I2.01 for specific location.

**PNT-7:** Benjamin Moore 1033; Wall pattern located in room 113 Incubation and 145 Hatchery Area, reference drawing I2.01 for specific location.

**PNT-8:** Benjamin Moore 049; Wall pattern located in room 113 Incubation and 145 Hatchery Area, reference drawing I2.01 for specific location.

- b. Vinyl Wall Covering(VWC): Versa, Vesuvio A24-825; locate on walls of Rm 131 Temporary Employee Support identified on drawing I2.01.
- c. Ceramic Tile:
  - CT-1:** Field Tile - Florida Tile, 2035 Almond; use unless otherwise noted.
  - CT-2:** Accent Tile - Florida Tile, 2025 Mexican SandReference drawing I2.01 for ceramic wall tile pattern.
- d. Ceramic Tile Grout (GR-3): C-Cure, #53 Bone.
- e. Metal Liner Panels (PNT-6): Benjamin Moore 968
- f. Exposed Structural Columns and Other Structural Steel Elements: Shall be painted to match the wall color in the room. Items in rooms with painted wall patterns shall match the wall pattern, excluding the painted squares. Reference drawing I2.01 for painted wall pattern.
- g. Polyurea Coating (PNT-9): Sherwin Williams, EnviroLastic 410 Light Gray
- h. Porcelain Tile (PT-3): Florida Tile, Ariostea/Geo Natura, 127A Britannia

#### 2.2.7 Interior Ceiling Finishes

Ceiling colors shall apply to ceiling surfaces including soffits, furred down areas, grilles, diffusers, registers, and access panels. Ceiling color shall also apply to joist, underside of roof deck, and conduit and piping where joists and deck are exposed and required to be painted. Ceiling materials shall be provided to match the colors listed below.

- a. Acoustical Tile and Grid: Manufacturer's standard white.
- b. Paint (PNT-6): Benjamin Moore 968.
- c. Metal Deck, Structural Beams and Other Structural Steel Elements (PNT-6): Benjamin Moore 968

#### 2.2.8 Interior Trim

Interior trim shall be provided to match the colors listed below.

- a. Painted Metal Doors (PNT-2): Benjamin Moore 469
- b. Painted Metal Door Frames (PNT-3): Benjamin Moore 1035
- c. Sectional Overhead Doors and Trim: Shall match adjacent wall in color, including wall pattern where applicable. Reference drawing

I2.01, typical painted wall pattern.

- d. Overhead Rolling Doors and Frames: Shall match adjacent wall in color, including wall pattern where applicable. Reference drawing I2.01, typical painted wall pattern.
- e. Windows (mullion, muntin, sash, trim, and stool):  
Room 101 side of interior windows in Rm 101 Display match the roof color.  
All other interior windows (excluding interior side of exterior windows) shall match PNT-3, Benjamin Moore 1035.
- f. Wood Doors (WS): Shall match Formica, 7288 Ginger Root Maple in color.
- g. Wood Window Sills (WS): Shall match Formica, 7288 Ginger Root Maple in color.
- h. Fire Extinguisher Cabinets: Shall match the wall in color.
- i. Handrails and Mezzanine (PNT-8): Benjamin Moore 049
- j. Exposed Ductwork (PNT-8): Benjamin Moore 049 (Excluding Rm 138 Mechanical, 139 Communications, and 140 Electrical.)
- k. Wood Stain(WS): Shall match Formica, 7288 Ginger Root Maple in color.

#### 2.2.9 Interior Window Treatment

Window treatments shall be provided to match the colors listed below.

- a. Horizontal Blinds (HB): Levolor, 316 Malibu Sand

#### 2.2.10 Interior Miscellaneous

Miscellaneous items shall be provided to match the colors listed below.

- a. Furniture Systems (FS):  
**Panel Fabric:** Herman Miller, Wickendon, Sweet Autumn 5K07  
**Flipper Door Fabric:** Herman Miller, Woodruff, Madder 4Y05  
**Tackboard Fabric:** Herman Miller, Resonance, Cornsilk 5T26  
**Worksurface Laminate:** Herman Miller, Fiber Laminate, Coriander 4X  
**Component Trim:** Herman Miller, Medium Tone  
**Pedestals:** Herman Miller, Medium Tone
- b. Toilet Partitions and Urinal Screen (TP): Knickerbocker, Sand #5123
- c. Lab Casework (Rooms 135 and 136):  
**Cabinet:** PL-1 - Formica, Colorado Slate 7014-58  
**Countertop and Backsplash:** Black Epoxy Resin
- d. Plastic Laminate: (See para. 2.2.10 Cabinetry for locations.)  
**PL-1:** Formica, Colorado Slate 7014-58  
**PL-2:** Formica, Earthen Terra 7215-58  
**PL-5:** Nevamar, Camouflage Chiasma CH500IT

- e. Solid Surface Material: (See para. 2.2.10 Cabinetry for locations.)  
**SS-1:** Corian, Moss (C)  
**SS-2:** Corian, Beige Fieldstone (F)  
**SS-3:** Corian, Bone (B)
- f. Cabinetry (excluding display cabinets in Room 101 Display and Room 100 Vestibule):

Room	Cabinet	Countertop, Skirt and Backsplash
102 Public Meeting Room	PL-5	SS-2
105 Employee Break Area	PL-1	SS-2
107 Women's	PL-2	SS-2
108 Men's	PL-2	SS-2
111 Utility	PL-1	SS-2
114 Men's Shower	PL-2	SS-2
115 Women's Shower	PL-2	SS-2
119 Office Work Area	PL-1	SS-1
131 Temporary Employee Support	WS	SS-2
124 and 128 Temporary Employee	WS	SS-2

Cabinet covers for toilets, excluding toilets rooms 126 and 130, shall match SS-3.

Cabinet covers for Employee Break Area shall match SS-2. Exposed wood bracket shall be painted the wall color PNT-1.

Steel channel under Room 102 Public Meeting Room countertop shall be painted the wall color.

- g. Solid Surface Sinks (SS-3): Corian, Bone (B)
- h. Display Cabinets (Room 101 Display):  
**PL-3:** WilsonArt, 4796-60 Burnished Chestnut; exterior plastic laminate  
**PL-4:** WilsonArt, D331-60 Sand; interior plastic laminate  
 Aluminum frame shall be clear anodized satin finish.
- i. Signage Message Color: Shall match PNT-1 Benjamin Moore 1037 in color.
- j. Signage Background Color: Shall match PNT-2 Benjamin Moore 469 and PNT-3 Benjamin Moore 1035 in color. Reference drawings for location of color. Blank back-up plates shall match PNT-3 in color.
- k. Lockers (LK): List Industries, Classics, Maroon
- l. Recessed Entrance Mat (Floor Mat - FM): C/S Entry Flooring Systems, #9305 Espresso
- m. Entry Carpet (EC): Lees, First Step, 524 Stepping Stone
- n. Wall Switch Handles and Standard Receptacle Bodies: Ivory
- o. Electrical Device Cover Plates and Panels: Ivory

- p. Painted Shelving and Supports (PNT-1): Benjamin Moore 1074.
- q. Operable Partitions (OP):
  - Fabric** - Hufcor, Stratus, Iron Ore 39-12
  - Trim** - Clear Anodized Aluminum or Dark Brown Baked Enamel
- r. Shower Curtain: Off-White or Cream
- s. Metal Rolling Counter Door, Hood and Frame (PNT-1): Benjamin Moore 1074
- t. Mezzanine Stairs and Walkway (PNT-8): Benjamin Moore 049
- u. Locker Room Wooden Benches:
  - Metal Base** - (PNT-3) Benjamin Moore 1035
  - Hardwood** - Manufacturers Standard Clear Finish
- v. Pay Telephone Cabinetry - Room 100 Vestibule (PL-3): WilsonArt, 4796-60 Burnished Chestnut

PART 3 EXECUTION (Not Applicable)

-- End of Section --

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SECTION 09965A

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12/02

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## SECTION 09965A

PAINTING: STEEL TANK STRUCTURES  
12/02

## PART 1 GENERAL

Work includes epoxy coating off-site for the interior and exterior of four (4) tanks, steel ladders, railings, catwalks, tank framing, access covers, and tank supports. The Tanks are labeled T-1, T-2, T-3 and T-4. The tank schedule is found on Sheet M8.13, plans are found on Sheet M8.03.

The contractor shall touch up on-site all steel ladders, railings, catwalks, tank drains, tank penetrations, tank framing, access covers, tank supports. Contractor shall not coat any aluminum, galvanized or stainless steel items. Contractor shall also coat with polyurethane the exterior portions of the tanks, steel ladders, railings, catwalks, tank framing, access covers, and tank supports on-site following the specified recoat windows.

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- |             |   |
|-------------|---|
| ANSI Z87.1  | (1989; R 1998) Occupational and Educational Eye and Face Protection |
| ANSI Z358.1 | (1998) Emergency Eyewash and Shower Equipment                       |

## ASTM INTERNATIONAL (ASTM)

- |            |   |
|------------|---|
| ASTM D 153 | (1984; R 1996e1) Specific Gravity of Pigments                                 |
| ASTM D 235 | (1999) Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent) |
| ASTM D 281 | (1995; R 2002) Oil Absorption of Pigments by Spatula Rub-Out                  |
| ASTM D 304 | (1995; R 1999) n-Butyl Alcohol (Butanol)                                      |
| ASTM D 520 | (2000) Zinc Dust Pigment  |
| ASTM D 561 | (1982; R 1996e1) Carbon Black Pigment for Paint                               |
| ASTM D 740 | (1994; R 2001) Methyl Ethyl Ketone  |
| ASTM D 841 | (2002) Nitration Grade Toluene  |

ASTM D 1152	(1997; R 2001) Methanol (Methyl Alcohol)
ASTM D 1153	(1994; R 2001) Methyl Isobutyl Ketone
ASTM D 1186	(2001) Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to a Ferrous Base
ASTM D 1200	(1994; R 1999) Viscosity by Ford Viscosity Cup
ASTM D 1210	(1996) Fineness of Dispersion of Pigment-Vehicle Systems by Hegman-Type Gage
ASTM D 1400	(2000) Nondestructive Measurement of Dry Film Thickness of Nonconductive Coatings Applied to a Nonferrous Metal Base
ASTM D 1475	(1998) Density of Paint, Liquid Coatings, Inks, and Related Products
ASTM D 1640	(1995; R 1999) Drying, Curing, or Film Formation of Organic Coatings at Room Temperature
ASTM D 2369	(2001e1) Volatile Content of Coatings
ASTM D 2917	(1991; R 1998) Methyl Isoamyl Ketone
ASTM D 4206	(1996; R 2001) Sustained Burning of Liquid Mixtures Using the Small Scale Open-Cup Apparatus
ASTM D 4417	(1993; R 1999) Field Measurement of Surface Profile of Blast Cleaned Steel
ASTM E 1347	(1997) Color and Color Difference Measurement by Tristimulus (Filter) Colorimetry

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1910.20	Access to Employee Exposure and Medical Records
29 CFR 1910.94	Ventilation
29 CFR 1910.134	Respiratory Protection
29 CFR 1910, Subpart I	Personal Protective Equipment
29 CFR 1926	Safety and Health Regulations for Construction
40 CFR 58, App E	Probe and Monitoring Path Siting Criteria for Ambient Air Quality Monitoring

40 CFR 117	Determination of Reportable Quantities for Hazardous Substances
40 CFR 122	EPA Administered Permit Programs: The National Pollutant Discharge Elimination System
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 261, App III	Chemical Analysis Test Methods
40 CFR 261, App II, Mtd 1311	Toxicity Characteristic Leaching Procedure (TCLP)
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 262.22	Number of Copies
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 302	Designation, Reportable Quantities, and Notification
40 CFR 355	Emergency Planning and Notification
49 CFR 171, Subchapter C	Hazardous Materials Regulations
U.S. GENERAL SERVICES ADMINISTRATION (GSA)	
FED-STD-595	(Rev B) Colors, Volume 1
U.S. ARMY CORPS OF ENGINEERS (USACE)	
EM 385-1-1	(1996) U.S. Army Corps of Engineers Safety and Health Requirements Manual
MIL-PRF-85285	(Rev. C) Coating: Polyurethane, High-Solids
MASTER PAINTERS INSTITUTE (MPI)	
MPI 72	(2001) Polyurethane, Two Component Pigmented, Gloss
U.S. DEPARTMENT OF DEFENSE (DOD)	
MIL-DTL-24441	(Rev C, Supp. 1) Paint, Epoxy-Polyamide
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 70	(2002) National Electrical Code
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)	
NIOSH 98-119	(1998, 4th Ed) Supplement 2 to NIOSH Manual of Analytical Methods

## THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC QP 1	(1998; R 2000) Standard Procedure for Evaluating Painting Contractors (Field Application to Complex Industrial Structures)
SSPC QP 3	(1998) Standard Procedure for Evaluating Qualifications of Shop Painting Certification Program
SSPC SP 1	(1982; R 2000) Solvent Cleaning
SSPC SP 3	(1982; R 2000) Power Tool Cleaning
SSPC SP 5	(2000) White Metal Blast Cleaning
SSPC SP 6	(2000) Commercial Blast Cleaning

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-03 Product Data

## Safety and Health Provisions; G-A

The Contractor shall submit an Accident Prevention Plan in accordance with the requirements of Section 01 of EM 385-1-1. The plan shall include, but is not limited to, each of the topic areas listed in Appendix A therein and the requirements of paragraph SAFETY AND HEALTH PROVISIONS; each topic shall be developed in a concise manner to include management and operational aspects.

## Respirators; G-A1

The Contractor shall submit a comprehensive written respiratory protection program in accordance with 29 CFR 1910.134, 29 CFR 1926.62, and Section 05.E of EM 385-1-1.

## SD-04 Samples

## Paint Formulations; G-A1

The Contractor shall submit samples of all special paint formula, Military, Master Painter Institute paints. For products that are specified to be applied in accordance with the manufacturer's recommendations the Contractor shall also submit the paint producers product data sheet or other written instructions for those products.

## Solvent and Thinners; G-A1

Samples shall be submitted of the thinners which are those solvents used to reduce the viscosity of the paint.

#### Inspection; G-A

The Contractor shall submit records of inspections and operations performed in accordance with paragraph INSPECTION. Submittals shall be made on a daily basis.

#### SD-07 Certificates

##### Qualifications; G-A1

The Contractor shall submit certification pursuant to paragraph QUALIFICATIONS for all job sites (on-site and off-site). Submittal of the qualifications and experience of any additional qualified and competent persons employed to provide on-site environmental, safety, and health shall also be provided. Acceptance of this submission must be obtained prior to the submission of other required environmental, safety, and health submittal items.

##### Coating System Component Compatibility; G-A1

Provide certification from each manufacturer of components of the coating system, epoxy primer, epoxy intermediate, and polyurethane topcoat, that the supplied coating material is suitable for use in the specified coating system. Each manufacturer shall identify the specific products, including manufacturer's name, which their product may be used with. The certification shall provide the name of the manufacturer that will provide technical support for the entire system. When all coating materials are manufactured by one manufacturer, this certification is not required.

##### Qualified Painting Contractor; G-A1

The Contractor shall submit a copy of their current SSPC QP 1 certification.

The Contractor shall submit a copy of a current SSPC QP 3 certification for the shop painted tanks.

##### Coating Thickness Gage Qualification; G-A

Documentation of manufacturer's certification shall be submitted for all coating thickness gages.

### 1.3 QUALIFICATIONS

Qualifications and experience shall comply with the following.

#### 1.3.1 Certified Professional

The Contractor shall utilize a qualified and competent person as defined in Section 01 of EM 385-1-1 to develop the required safety and health submittal and to provide on-site safety and health services during the contract period. The person shall be a Certified Industrial Hygienist (CIH), an Industrial Hygienist (IH), or a Certified Safety Professional (CSP) with a minimum of 3 years of demonstrated experience in similar related work. The Contractor shall certify that the Certified Industrial

Hygienist (CIH) holds current and valid certification from the American Board of Industrial Hygiene (ABIH), that the IH is considered board eligible by written confirmation from the ABIH, or that the CSP holds current and valid certification from the American Board of Certified Safety Professionals. The CIH, IH, QMP, or CSP may utilize other qualified and competent persons, as defined in EM 385-1-1, to conduct on-site safety and health activities as long as these persons have a minimum of 2 years of demonstrated experience in similar related work and are under the direct supervision of the CIH, IH, or CSP.

#### 1.3.2 Qualified Painting Contractor

The Contractor shall be a certified SSPC-QP 1 Painting Contractor.

#### 1.3.3 Qualified Paint Applicator

Documentation of certification shall be submitted for all paint applicators. Prior to the initiation of any work all paint applicators shall be tested and certified as meeting the requirements of the qualified paint applicator. Certification shall be administered by the government approved independent third party Test Agency. Applicators failing the certification test shall not be permitted to apply any paint on the project.

##### 1.3.3.1 Certification Criteria

The paint applicator shall be evaluated based on the conformance of the applied paint system to the requirements of the specifications. Deficiencies in the coatings, improper mixing or improper application methods are basis for failure. The Test Agency shall be the sole judge as to the acceptability of each paint applicators performance.

#### 1.3.4 Coating Thickness Gage Qualification

Documentation of certification shall be submitted for all coating thickness gages. Magnetic flux thickness gages as described in ASTM D 1186 shall be used to make all coating thickness measurements on ferrous metal substrates.

Gages shall have an accuracy of +/- 3 percent or better. Gages to be used on the job shall be certified by the manufacturer as meeting these requirements.

#### 1.4 SAMPLING AND TESTING

The Contractor shall allow at least 30 days for sampling and testing. Sampling may be at the jobsite or source of supply. The Contractor shall notify the Contracting Officer when the paint and thinner are available for sampling. Sampling of each batch shall be witnessed by the Contracting Officer unless otherwise specified or directed. Contracting Officer may direct the paint sample be collected by a QP 1 certified personnel. A 1-quart sample of paint and thinner shall be submitted for each batch proposed for use. The sample shall be labeled to indicate formula or specification number and nomenclature, batch number, batch quantity, color, date made, and applicable project contract number. Testing will be performed by the Government. Costs for retesting rejected material will be deducted from payments to the Contractor at the rate of \$500 dollars for each paint sample retested and \$500 dollars for each thinner retested.

#### 1.5 SAFETY AND HEALTH PROVISIONS

Work shall be performed in accordance with the requirements of 29 CFR 1910,

29 CFR 1926, EM 385-1-1, and other references as listed herein. Matters of interpretation of the standards shall be submitted to the Contracting Officer for resolution before starting work. Where the regulations conflict, the most stringent requirements shall apply. Paragraph SAFETY AND HEALTH PROVISIONS supplements the requirements of EM 385-1-1, paragraph (1). In any conflict between Section 01 of EM 385-1-1 and this paragraph, the provisions herein shall govern.

#### 1.5.1 Abrasive Blasting

The Contractor shall comply with the requirements in Section 06.H of EM 385-1-1.

##### 1.5.1.1 Hoses And Nozzles

In addition to the requirements in Section 20 of EM 385-1-1, hoses and hose connections of a type to prevent shock from static electricity shall be used. Hose lengths shall be joined together by approved couplings of a material and type designed to prevent erosion and weakening of the couplings. The couplings and nozzle attachments shall fit on the outside of the hose and shall be designed to prevent accidental disengagement.

##### 1.5.1.2 Workers Other Than Blasters

Workers other than blasting operators working in close proximity to abrasive blasting operations shall be protected by utilizing MSHA/NIOSH-approved half-face or full-face air purifying respirators equipped with high-efficiency particulate air (HEPA) filters, eye protection meeting or exceeding ANSI Z87.1 and hearing protectors (ear plugs and/or ear muffs) providing a noise reduction rating of at least 20 dBA or as needed to provide adequate protection.

#### 1.5.2 Cleaning with Compressed Air

Cleaning with compressed air shall be in accordance with Section 20.B.5 of EM 385-1-1 and personnel shall be protected as specified in 29 CFR 1910.134.

#### 1.5.3 Cleaning with Solvents

##### 1.5.3.1 Ventilation

Ventilation shall be provided where required by 29 CFR 1910.146 or where the concentration of solvent vapors exceeds 10 percent of the Lower Explosive Limit (LEL). Ventilation shall be in accordance with 29 CFR 1910.94, paragraph (c)(5).

##### 1.5.3.2 Personal Protective Equipment

Personal protective equipment shall be provided where required by 29 CFR 1910.146 and in accordance with 29 CFR 1910, Subpart I.

#### 1.5.4 Mixing Epoxy Formulations

##### 1.5.4.1 Exhaust Ventilation

Local exhaust ventilation shall be provided in the area where the curing agent and resin are mixed. This ventilation system shall be capable of providing at least 100 linear fpm of capture velocity measured at the point where the curing agent and resin contact during mixing.

#### 1.5.4.2 Personal Protective Equipment

Exposure of skin and eyes to epoxy resin components shall be avoided by wearing appropriate chemically resistant gloves, apron, safety goggles, and face shields meeting or exceeding the requirements of ANSI Z87.1.

#### 1.5.4.3 Medical Precautions

Individuals who have a history of sensitivity to epoxy or polyurethane resin systems shall be medically evaluated before any exposure can occur. Individuals who are medically evaluated as exhibiting a sensitivity to epoxy resins shall not conduct work tasks or otherwise be exposed to such chemicals. Individuals who develop a sensitivity shall be immediately removed from further exposure and medically evaluated.

#### 1.5.4.4 Emergency Equipment

A combination unit, comprised of an eyewash and deluge shower, within close proximity to the epoxy or polyurethane resin mixing operation shall be provided in accordance with ANSI Z358.1, paragraph (9).

#### 1.5.5 Paint Application

##### 1.5.5.1 Ventilation

When using solvent-based paint in confined spaces, ventilation shall be provided to exchange air in the space at a minimum rate of 5,000 cubic feet per minute per spray gun in operation. It may be necessary to install both a mechanical supply and exhaust ventilation system to effect adequate air changes within the confined space. All air-moving devices shall be located and affixed to an opening of the confined space in a manner that assures that the airflow is not restricted or short circuited and is supplied in the proper direction. Means of egress shall not be blocked. Ventilation shall be continued after completion of painting and through the drying phase of the operation. If the ventilation system fails or the concentration of volatiles exceeds 10 percent of the LEL (except in the zone immediately adjacent to the spray nozzle), painting shall be stopped and spaces evacuated until such time that adequate ventilation is provided.

An audible alarm that signals system failure shall be an integral part of the ventilation system. The effectiveness of the ventilation shall be checked by using ventilation smoke tubes and making frequent oxygen and combustible gas readings during painting operations. Exhaust ducts shall discharge clear of the working areas and away from possible sources of ignition.

##### 1.5.5.2 Explosion Proof Equipment

Electrical wiring, lights, and other equipment located in the paint spraying area shall be of the explosion proof type designed for operation in Class I, Division 1, Group D, hazardous locations as required by the NFPA 70. Electrical wiring, motors, and other equipment, outside of but within 20 feet of any spraying area, shall not spark and shall conform to the provisions for Class I, Division 2, Group D, hazardous locations. Electric motors used to drive exhaust fans shall not be placed inside spraying areas or ducts. Fan blades and portable air ducts shall be constructed of nonferrous materials. Motors and associated control equipment shall be properly maintained and grounded. The metallic parts of air-moving devices, spray guns, connecting tubing, and duct work shall be

electrically bonded and the bonded assembly shall be grounded.

#### 1.5.5.3 Further Precautions

- a. Workers shall wear nonsparking safety shoes.
- b. Solvent drums taken into the spraying area shall be placed on nonferrous surfaces and shall be grounded. Metallic bonding shall be maintained between containers and drums when materials are being transferred.
- c. Insulation on all power and lighting cables shall be inspected to ensure that the insulation is in excellent working condition and is free of all cracks and worn spots. Cables shall be further inspected to ensure that no connections are within 50 feet of the operation, that lines are not overloaded, and that they are suspended with sufficient slack to prevent undue stress or chafing.

#### 1.5.5.4 Ignition Sources

Ignition sources, to include lighted cigarettes, cigars, pipes, matches, or cigarette lighters shall be prohibited in area of solvent cleaning, paint storage, paint mixing, or paint application.

#### 1.5.6 Health Protection

##### 1.5.6.1 Respirators

During all spray painting operations, spray painters shall use approved SCBA or SAR (air line) respirators, unless valid air sampling has demonstrated contaminant levels to be consistently within concentrations that are compatible with air-purifying respirator Assigned Protection Factor (APF). Persons with facial hair that interferes with the sealing surface of the facepiece to face seal or interferes with respirator valve function shall not be allowed to perform work requiring respiratory protection. Air-purifying chemical cartridge/canister half- or full-facepiece respirators that have a particulate prefilter and are suitable for the specific type(s) of gas/vapor and particulate contaminant(s) may be used for nonconfined space painting, mixing, and cleaning (using solvents). These respirators may be used provided the measured or anticipated concentration of the contaminant(s) in the breathing zone of the exposed worker does not exceed the APF for the respirator and the gas/vapor has good warning properties or the respirator assembly is equipped with a NIOSH-approved end of service life indicator for the gas(es)/vapor anticipated or encountered. Where paint contains toxic elements such as lead, cadmium, chromium, or other toxic particulates that may become airborne during painting in nonconfined spaces, air-purifying half- and full-facepiece respirators or powered air-purifying respirators equipped with appropriate gas vapor cartridges, in combination with a high-efficiency filter, or an appropriate canister incorporating a high-efficiency filter, shall be used.

##### 1.5.6.2 Protective Clothing and Equipment

All workers shall wear safety shoes or boots, appropriate gloves to protect against the chemical to be encountered, and breathable, protective, full-body covering during spray-painting applications. Where necessary for emergencies, protective equipment such as life lines, body harnesses, or other means of personnel removal shall be used during confined-space work.

## 1.6 MEDICAL STATUS

Prior to the start of work and annually thereafter, all Contractor employees working with or around paint systems, thinners, blast media, those required to wear respiratory protective equipment, and those who will be exposed to high noise levels shall be medically evaluated for the particular type of exposure they may encounter. Medical records shall be maintained as required by 29 CFR 1910.20. The evaluation shall include:

- a. Audiometric testing and evaluation of employees who will work in a noise environment with a time weighted average greater than or equal to 90 dBA.
- b. Vision screening (employees who use full-facepiece respirators shall not wear contact lenses).
- c. Medical evaluation shall include, but shall not be limited to, the following:
  - (1) Medical history including, but not limited to, alcohol use, with emphasis on liver, kidney, and pulmonary systems, and sensitivity to chemicals to be used on the job.
  - (2) General physical examination with emphasis on liver, kidney, and pulmonary system.
  - (3) Determination of the employee's physical and psychological ability to wear respiratory protective equipment and to perform job-related tasks.
  - (4) Determination of baseline values of biological indices for later comparison to changes associated with exposure to paint systems and thinners or blast media, which include: liver function tests to include SGOT, SGPT, GGPT, alkaline phosphates, bilirubin, complete urinalysis, EKG (employees over age 40), blood urea nitrogen (bun), serum creatinine, pulmonary function test, FVC, and FEV, chest x-ray (if medically indicated), blood lead and ZPP (for individuals where it is known there will be an exposure to materials containing lead), other criteria that may be deemed necessary by the Contractor's physician, and Physician's statements for individual employees that medical status would permit specific task performance.

## 1.7 CHANGE IN MEDICAL STATUS

Any employee whose medical status has changed negatively due to work related chemical and/or physical agent exposure while working with or around paint systems and thinners, blast media, or other chemicals shall be evaluated by a physician, and the Contractor shall obtain a physicians statement as described in paragraph MEDICAL STATUS prior to allowing the employee to return to those work tasks. The Contractor shall notify the Contracting Officer in writing of any negative changes in employee medical status and the results of the physicians reevaluation statement.

## 1.8 ENVIRONMENTAL PROTECTION

In addition to the requirements of section 01354 the Contractor shall comply with the following environmental protection criteria.

### 1.8.1 Waste Classification, Handling, and Disposal

The Contractor shall be responsible for assuring the proper disposal of all hazardous and nonhazardous waste generated during the project. Nonhazardous waste shall be stored in closed containers separate from hazardous waste storage areas. All nonhazardous waste shall be transported in accordance with local regulations regarding waste transportation.

### 1.9 PAINT PACKAGING, DELIVERY, AND STORAGE

Paints shall be processed and packaged to ensure that within a period of one year from date of manufacture, they will not gel, liver, or thicken deleteriously, or form gas in the closed container. Paints, unless otherwise specified or permitted, shall be packaged in standard containers not larger than 5 gallons, with removable friction or lug-type covers. Containers for vinyl-type paints shall be lined with a coating resistant to solvents in the formulations and capable of effectively isolating the paint from contact with the metal container. Each container of paint or separately packaged component thereof shall be labeled to indicate the purchaser's order number, date of manufacture, manufacturer's batch number, quantity, color, component identification and designated name, and formula or specification number of the paint together with special labeling instructions, when specified. Paint shall be delivered to the job in unbroken containers. Paints that can be harmed by exposure to cold weather shall be stored in ventilated, heated shelters. All paints shall be stored under cover from the elements and in locations free from sparks and flames.

## PART 2 PRODUCTS

### 2.1 SPECIAL PAINT FORMULAS

Special paints shall have the composition as indicated in the formulas listed herein. Where so specified, certain components of a paint formulation shall be packaged in separate containers for mixing on the job.

If not specified or otherwise prescribed, the color shall be that naturally obtained from the required pigmentation.

## PART 3 EXECUTION

### 3.1 CLEANING AND PREPARATION OF SURFACES TO BE PAINTED

#### 3.1.1 General Requirements

Surfaces to be painted shall be cleaned before applying paint or surface treatments. Deposits of grease or oil shall be removed in accordance with SSPC SP 1, prior to mechanical cleaning. Solvent cleaning shall be accomplished with mineral spirits or other low toxicity solvents having a flash point above 100 degrees F. Clean cloths and clean fluids shall be used to avoid leaving a thin film of greasy residue on the surfaces being cleaned. Items not to be prepared or coated shall be protected from damage by the surface preparation methods. Cleaning and painting shall be so programmed that dust or other contaminants from the cleaning process do not fall on wet, newly painted surfaces, and surfaces not intended to be painted shall be suitably protected from the effects of cleaning and painting operations. Welding of, or in the vicinity of, previously painted surfaces shall be conducted in a manner to prevent weld spatter from striking the paint and to otherwise reduce coating damage to a minimum; paint damaged by welding operations shall be restored to original

condition. Surfaces to be painted that will be inaccessible after construction, erection, or installation operations are completed shall be painted before they become inaccessible.

### 3.1.2 Ferrous Surfaces Subject to Severe Exposure

Ferrous surfaces subject to extended periods of immersion, such as tank interiors, or as otherwise required shall be dry blast-cleaned to SSPC SP 5.

The blast profile, unless otherwise specified, shall be 1.5 to 2.5 mils as measured by ASTM D 4417, Method C. Appropriate abrasive blast media shall be used to produce the desired surface profile and to give an angular anchor tooth pattern. If recycled blast media is used, an appropriate particle size distribution shall be maintained so that the specified profile is consistently obtained. Steel shot or other abrasives that do not produce an angular profile shall not be used. Weld spatter not dislodged by blasting shall be removed with impact or grinding tools and the areas reblasted prior to painting. Surfaces shall be dry at the time of blasting. Blast cleaning to SSPC SP 5 shall be done in the field and, unless otherwise specifically authorized, after final erection. Within 8 hours after cleaning, prior to the deposition of any detectable moisture, contaminants, or corrosion, all ferrous surfaces blast cleaned to SSPC SP 5 shall be cleaned of dust and abrasive particles by brush, vacuum cleaner, and/or blown down with clean, dry, compressed air, and given the first coat of paint. Upon written request by the Contractor, the Contracting Officer may authorize mill or shop cleaning of assembled or partially assembled components specified to receive Systems No. 21-A-Z employing the epoxy zinc-rich primer. The surfaces, if shop blasted, shall be shop coated with the first and second coats of the specified paint system except that the epoxy zinc-rich primed surfaces shall receive an extra single spray coat of the zinc primer at the time field painting is started, as specified in the paint system instructions. The shop coating shall be maintained in good condition by cleaning and touching up of areas damaged during the construction period. If pinpoint or general rusting appears, surfaces shall be reblasted and repainted at no added cost to the Government. Prior to the field application of subsequent coats, soiled areas of the shop coating shall be thoroughly cleaned and all welds or other unpainted or damaged areas shall be cleaned and coated in a manner to make them equivalent to adjacent, undamaged paint surfaces.

### 3.1.3 Damp and Wet Ferrous Metal Surfaces

Ferrous surfaces that are wet with condensation or standing or running water, shall be blast-cleaned to SSPC SP 5. The blast profile, unless otherwise specified, shall be 1.5 to 3.0 mils as measured by ASTM D 4417, Method C. Appropriate abrasive blast media shall be used to produce the desired surface profile and to give an angular anchor tooth pattern. Steel grit or shot media shall not be used. Weld spatter not dislodged by blasting shall be removed with impact or grinding tools and the areas reblasted prior to painting. Surfaces shall be as dry as possible at the time of blasting. Immediately after cleaning and prior to the formation of extensive corrosion products, all ferrous surfaces blast cleaned to SSPC SP 5 shall be cleaned of residual abrasive particles, and given the first coat of paint. A slightly visible rust bloom shall be permitted on surfaces to be painted.

## 3.2 PAINT APPLICATION

### 3.2.1 General

The finished coating shall be free from holidays, pinholes, bubbles, runs,

drops, ridges, waves, laps, excessive or unsightly brush marks, and variations in color, texture, and gloss. Application of Topcoat shall not commence until the Contracting Officer has verified that atmospheric conditions and the surfaces to be coated are satisfactory. Each paint coat shall be applied in a manner that will produce an even, continuous film of uniform thickness. Edges, corners, crevices, seams, joints, welds, rivets, corrosion pits, and other surface irregularities shall receive special attention to ensure that they receive an adequate thickness of paint. Spray equipment shall be equipped with traps and separators and where appropriate, mechanical agitators, pressure gauges, pressure regulators, and screens or filters. Air caps, nozzles, and needles shall be as recommended by the spray equipment manufacturer for the material being applied. Airless-type spray equipment may be used only on broad, flat, or otherwise simply configured surfaces, except that it may be employed for general painting if the spray gun is equipped with dual or adjustable tips of proper types and orifice sizes. Airless-type equipment shall not be used for the application of vinyl paints.

### 3.2.2 Mixing and Thinning

Paints shall be thoroughly mixed, strained where necessary, and kept at a uniform composition and consistency during application. Paste or dry-powder pigments specified to be added at the time of use shall, with the aid of powered stirrers, be incorporated into the vehicle or base paint in a manner that will produce a smooth, homogeneous mixture free of lumps and dry particles. Where necessary to suit conditions of the surface temperature, weather, and method of application, the paint may be thinned immediately prior to use. Thinning shall generally be limited to the addition of not more than 1 pint per gallon of the proper thinner; this general limitation shall not apply when more specific thinning instructions are provided. Paint that has been stored at low temperature, shall be brought up to at least 70 degrees F before being mixed and thinned, and its temperature in the spray tank or other working container shall not fall below 60 degrees F during the application. Paint that has deteriorated in any manner to a degree that it cannot be restored to essentially its original condition by customary field-mixing methods shall not be used and shall be removed from the project site. Paint and thinner that is more than 1 year old shall be resampled and resubmitted for testing to determine its suitability for application.

### 3.2.3 Atmospheric and Surface Conditions

Paint shall be applied only to surfaces that are above the dew point temperature and that are completely free of moisture as determined by sight and touch. Paint shall not be applied to surfaces upon which there is detectable frost or ice. Except as otherwise specified, the temperature of the surfaces to be painted and of air in contact therewith shall be not less than 45 degrees F during paint application nor shall paint be applied if the surfaces can be expected to drop to 32 degrees F or lower before the film has dried to a reasonably firm condition. During periods of inclement weather, painting may be continued by enclosing the surfaces and applying artificial heat, provided the minimum temperatures and surface dryness requirements prescribed previously are maintained. Paint shall not be applied to surfaces heated by direct sunlight or other sources to temperatures that will cause detrimental blistering, pinholing, or porosity of the film.

### 3.2.4 Time Between Surface Preparation and Painting

Surfaces that have been cleaned and/or otherwise prepared for painting shall be primed as soon as practicable after such preparation has been completed but, in any event, prior to any deterioration of the prepared surface.

### 3.2.5 Method of Paint Application

Unless otherwise specified, paint shall be applied by brush or spray to ferrous and nonferrous metal surfaces. Special attention shall be directed toward ensuring adequate coverage of edges, corners, crevices, pits, rivets, bolts, welds, and similar surface irregularities. Other methods of application to metal surfaces shall be subject to the specific approval of the Contracting Officer. Paint on plaster, concrete, or other nonmetallic surfaces shall be applied by brush, roller, and/or spray.

### 3.2.6 Coverage and Film Thickness

Film thickness or spreading rates shall be as specified hereinafter. Where no spreading rate is specified, the paint shall be applied at a rate normal for the type of material being used. In any event, the combined coats of a specified paint system shall completely hide base surface and the finish coats shall completely hide undercoats of dissimilar color.

#### 3.2.6.1 Measurement on Ferrous Metal

Where dry film thickness requirements are specified for coatings on ferrous surfaces, measurements shall be made with a gage qualified in accordance with paragraph Coating Thickness Gage Qualification. They shall be calibrated and used in accordance with ASTM D 1186. They shall be calibrated using plastic shims with metal practically identical in composition and surface preparation to that being coated, and of substantially the same thickness (except that for measurements on metal thicker than 1/4 inch, the instrument may be calibrated on metal with a minimum thickness of 1/4 inch). Frequency of measurements shall be as recommended for field measurements by ASTM D 1186 and reported as the mean for each spot determination. The instruments shall be calibrated or calibration verified prior to, during, and after each use.

### 3.2.7 Progress of Painting Work

Where field painting on any type of surface has commenced, the complete painting operation on that portion of the work shall be completed as soon as practicable, without prolonged delays. Sufficient time shall elapse between successive coats to permit them to dry properly for recoating, and this period shall be modified as necessary to suit adverse weather conditions. Paint shall be considered dry for recoating when it feels firm, does not deform or feel sticky under moderate pressure of the finger, and the application of another coat of paint does not cause film irregularities such as lifting or loss of adhesion of the undercoat. All coats of all painted surfaces shall be unscarred and completely integral at the time of application of succeeding coats. At the time of application of each successive coat, undercoats shall be cleaned of dust, grease, overspray, or foreign matter by means of airblast, solvent cleaning, or other suitable means. Cement and mortar deposits on painted steel surfaces, not satisfactorily removed by ordinary cleaning methods, shall be brush-off blast cleaned and completely repainted as required. Undercoats of high gloss shall, if necessary for establishment of good adhesion, be scuff sanded, solvent wiped, or otherwise treated prior to application of a succeeding coat. Field coats on metal shall be applied after erection

except as otherwise specified and except for surfaces to be painted that will become inaccessible after erection.

### 3.2.7.1 Application Conditions and Recoat Windows

The application condition requirements for the coating system are very time and temperature sensitive, and are intended to avoid the delamination problems frequently found on industrial structures. Plan coating application to ensure that specified temperature, humidity, and condensation conditions are met. If conditions do not allow for orderly application of primer, stripe coat, intermediate coat and topcoat, use appropriate means of controlling air and surface temperatures, as required.

Partial or total enclosures may be required, as well as other measures, to control conditions to allow for orderly application of all required coats.

Apply coating only when ambient air and steel temperatures are between 60 and 100 degrees F, and steel surface temperature is more than 5 degrees F above the dew-point of the ambient air during application and the first four hours for epoxy and the first eight hours for polyurethane. Do not apply coatings above 100 degrees F or below 60 degrees F.

Use Table entitled "RECOAT WINDOWS" to determine appropriate recoat windows for each coat after the initial coat. Apply each coating during appropriate RECOAT WINDOW.

If coating is not applied during RECOAT WINDOW, apply during EXTENDED RECOAT WINDOW. Application of any epoxy coat within the EXTENDED RECOAT WINDOW requires application of a TACK COAT prior to applying any full coat.

Perform cure test immediately prior to application of TACK COAT to determine condition of applied coating. If CURE TEST indicates that surface is fully cured, provide GLOSS REMOVAL prior to application of TACK COAT.

If coating is not applied during EXTENDED RECOAT WINDOW, or if surface temperature exceeds 120 degrees F between applications, wash surface with water and detergent, rinse clean with fresh water and allow surface to dry thoroughly, provide GLOSS REMOVAL, apply TACK COAT, where applicable, within 24 hours, and apply next full coat within TACK COAT RECOAT WINDOW.

#### RECOAT WINDOWS

##### EPOXY OVER EPOXY MOSTLY OFF-SITE AND ONLY ON-SITE IF TANKS ARE DAMAGED

Temperature degrees F	60-70	71-80	81-90	91-100	101-110	111-120
RECOAT WINDOW (Hrs.)	24-72	18-60	16-48	12-36	8-18	4-6
EXTENDED RECOAT WINDOW (Hrs.)	72-168	60-140	48-120	36-96	18-36	6-12
TACK COAT RECOAT WINDOW (Hrs.)	6-72	4-60	4-48	3-36	2-18	1-6

##### POLYURETHANE OVER EPOXY ON-SITE

Temperature degrees F	60-70	71-80	81-90	91-100	101-110	111-120
RECOAT WINDOW (Hrs.)	24-96	24-72	16-48	12-36	10-24	8-16
EXTENDED RECOAT WINDOW (Hrs.)	96-168	72-144	48-120	36-96	24-48	16-24
TACK COAT RECOAT	24-96	24-72	16-48	12-36	10-24	8-16

## RECOAT WINDOWS

WINDOW (Hrs.)

## POLYURETHANE OVER POLYURETHANE ON-SITE

Temperature degrees F	60-70	71-80	81-90	91-100	101-110	111-120
RECOAT WINDOW (Hrs.)	8-48	6-48	4-36	3-24	2-12	1-2
EXTENDED RECOAT WINDOW (Hrs.)	NONE	-----	-----	-----	-----	-----
TACK COAT RECOAT WINDOW (Hrs.)	NO TACK COAT USED	-----	-----	-----	-----	-----

The temperature ranges shown in the table above are for determining recoat windows. Choose recoat window based on the highest surface temperature that was sustained for one or more hours between coats. This applies to the entire time between coats. Measure and record air and surface temperatures on hourly basis to determine appropriate recoat windows. If surface temperature goes above 100 degrees F, measure and record temperatures every half hour.

CURE TEST - Where indicated, test surface for cure using high-flash aromatic Naphtha only (cas #64742-95-6). Do not use aliphatic VMP Naphtha.

Wipe surface with rag saturated with Naphtha, and check for surface tackiness, loss of gloss, or other indications that solvent has softened surface. If softening is found on 95% of test sites, this is indication that coating has not fully cured, and GLOSS REMOVAL is not required if TACK COAT is applied within three hours and full coat is applied within the TACK COAT RECOAT WINDOW. Test surfaces at rate of three tests for the first 1000 square feet plus one test for each additional 1000 square feet or part thereof.

TACK COAT - Where indicated, apply coat of intermediate coat epoxy, at 1 to 2 mils WFT, then apply next specified full coat within TACK COAT RECOAT WINDOW. Thin TACK COAT material approximately 25% by volume, using appropriate epoxy thinner.

GLOSS REMOVAL - Where indicated, remove all gloss by hand sanding with 150-200 grit wet/dry sandpaper in a linear fashion, pressure wash or wipe down with a clean rag soaked with denatured alcohol to remove dust. Do not use rotary sanders or grinders.

## 3.7.2 Application of Coating System

Apply coatings in accordance with SSPC PA 1 and as specified herein. Apply coatings to surfaces that meet all stated surface preparation requirements.

After application of primer coat and prior to application of each subsequent coat, perform testing for surface contamination as necessary, to ensure minimal intercoat contamination. Generally, oil and grease contamination and soluble salts contamination are not encountered if subsequent coats are applied within specified recoat windows and unusual atmospheric events do not occur. Concern for intercoat contamination should be continually prevalent, and spot testing should be accomplished to verify satisfactory conditions. Where visual examination or spot testing indicates contamination, perform sufficient testing to verify non-contamination, or to define extent of contamination for appropriate treatment.

Apply each coat in a consistent wet film, at 90 degrees to previous coat. Ensure that primer and intermediate coat "cold joints" are no less than six inches from welds. Apply stripe coat by brush. Apply all other coats by spray application. Use appropriate controls to prevent airborne coating fog from drifting beyond containment. Cover or protect all surfaces that will not be coated. The cleanliness, temperature, recoat windows, and airborne paint containment requirements may necessitate the use of enclosures, portable shelters, or other appropriate controls.

Apply coatings at the following specified thickness:

Coat	Desired Thickness Range	Minimum	Maximum
	Mils DFT	Mils DFT	Mils DFT
Primer	2 - 5	2	6
Intermediate	3 - 5	3	8
Top	2 - 3	2	4
Total system	-----	9	12

### 3.2.7.2 Application of Primer Off-site

Apply primer coat, maintaining paint supply container height within 3 feet of the paint nozzle for applying zinc primer. Maintain constant agitation of paint pot to ensure that zinc does not settle in container.

### 3.2.7.3 Application of Stripe Coat

Apply a stripe coat of intermediate coat epoxy material within RECOAT WINDOW of primer, allowing sufficient dry time to allow application of intermediate coat within RECOAT WINDOW of primer. Apply by brush, working material into corners, crevices, angles, and welds, and onto outside corners and angles.

### 3.2.7.4 Application of Intermediate Coat Off-site

Apply intermediate coat within RECOAT WINDOW of primer coat.

### 3.2.7.5 Application of Topcoat On-site

Make all required repairs to primer and intermediate coats as specified. Apply topcoat within RECOAT WINDOW of intermediate coat. The polyurethane topcoat may require multiple passes to achieve desired aesthetics and required thickness. Consult manufacturer for thinning and application procedures for anticipated temperature, humidity, and wind conditions. Touch-up blemishes and defects within recoat window of polyurethane topcoat. Retain sample of polyurethane topcoat, from the same batch used to coat structure, to make touch-ups that might be required later.

### 3.2.8 Contacting Surfaces

When riveted or ordinary bolted contact is to exist between surfaces of ferrous or other metal parts of substantially similar chemical composition, such surfaces will not be required to be painted, but any resulting crevices shall subsequently be filled or sealed with paint. Contacting metal surfaces formed by high-strength bolts in friction-type connections shall not be painted. Where a nonmetal surface is to be in riveted or bolted contact with a metal surface, the contacting surfaces of the metal

shall be cleaned and given three coats of the specified primer. Unless otherwise specified, corrosion-resisting metal surfaces, including cladding therewith, shall not be painted.

### 3.2.9 Drying Time Prior to Immersion

Minimum drying periods after final coat prior to immersion shall be: epoxy systems at least 5 days. Minimum drying periods shall be increased twofold if the drying temperature is below 65 degrees F and/or if the immersion exposure involves considerable abrasion.

### 3.2.10 Protection of Painted Surfaces

Where shelter and/or heat are provided for painted surfaces during inclement weather, such protective measures shall be maintained until the paint film has dried and discontinuance of the measures is authorized. Items that have been painted shall not be handled, worked on, or otherwise disturbed until the paint coat is fully dry and hard. All metalwork coated in the shop or field prior to final erection shall be stored out of contact with the ground in a manner and location that will minimize the formation of water-holding pockets; soiling, contamination, and deterioration of the paint film, and damaged areas of paint on such metalwork shall be cleaned and touched up without delay. The first field coat of paint shall be applied within a reasonable period of time after the shop coat and in any event before weathering of the shop coat becomes extensive.

## 3.3 PAINT SYSTEMS APPLICATION

The required paint systems and the surfaces to which they shall be applied are shown in this paragraph, and/or in the drawings. Supplementary information follows.

### 3.3.1 Fabricated and Assembled Items

Items that have been fabricated and/or assembled into essentially their final form and that are customarily cleaned and painted in accordance with the manufacturer's standard practice will be exempted from equivalent surface preparation and painting requirements described herein, provided that:

- a. Surfaces primed (only) in accordance with such standard practices are compatible with specified field-applied finish coats.
- b. Surfaces that have been primed and intermediate coats painted in accordance with the manufacturer's standard practice are of acceptable color and are capable of being satisfactorily touched up in the field.
- c. Items expressly designated herein to be cleaned and painted in a specified manner are not coated in accordance with the manufacturer's standard practice if different from that specified herein.

### 3.3.2 Surface Preparation

The method of surface preparation and pretreatment shown in the tabulation of paint systems is for identification purposes only. Cleaning and pretreatment of surfaces prior to painting shall be accomplished in accordance with detailed requirements previously described.

### 3.3.3 Protection of Nonpainted Items and Cleanup

Walls, equipment, fixtures and all other items in the vicinity of the surfaces being painted shall be maintained free from damage by paint or painting activities. Paint spillage and painting activity damage shall be promptly repaired.

### 3.4 INSPECTION

The Contractor shall inspect, document, and report all work phases and operations on a daily basis. As a minimum the daily report shall contain the following:

- a. Inspections performed, including the area of the structure involved and the results of the inspection.
- b. Surface preparation operations performed, including the area of the structure involved, the mode of preparation, the kinds of solvent, abrasive, or power tools employed, and whether contract requirements were met.
- c. Thinning operations performed, including thinners used, batch numbers, and thinner/paint volume ratios.
- d. Application operations performed, including the area of the structure involved, mode of application employed, ambient temperature, substrate temperature, dew point, relative humidity, type of paint with batch numbers, elapsed time between surface preparation and application, elapsed time for recoat, condition of underlying coat, number of coats applied, and if specified, measured dry film thickness or spreading rate of each new coating.

### 3.5 PAINTING SCHEDULES

#### SYSTEM NO. 21-A-Z

Items or surfaces to be coated: Tank Interiors

Work includes coating of the interior of four (4) tanks off-site with epoxy. The Tanks are labeled T-1, T-2, T-3 and T-4. The tank schedule is found on Sheet M8.13, Plans are found on Sheet M8.03. Contractor shall not coat any aluminum, galvanized or stainless steel items.

SURFACE PREPARATION	1st & 2nd COAT	3rd & 4th COAT	5th COAT
As specified for each type of surface	MIL-DTL-24441 /19B	MIL-DTL-24441, Sheet M8.03 & M8.13, Color No. White	MIL-DTL-24441 As needed to meet 9 to 12 mils

#### SYSTEM NO. 21-A-Z Modified

Items or surfaces to be coated: Tank Exteriors

Work includes coating the exterior of four (4) tanks off site with epoxy and on-site with polyurethane. The Tanks are labeled T-1, T-2, T-3 and T-4. The tank schedule is found on Sheet M8.13, Plans are found on Sheet

M8.03. Contractor shall coat off-site the epoxy coats. The contractor shall apply the topcoat and any touch up on-site of the 4 tanks to include all exterior steel ladders, railings, catwalks, tank penetrations, tank framing, access covers, and tank supports. Contractor shall recoat any damaged epoxy coatings onsite that is damaged during installation and shipping. Contractor shall not coat any aluminum, galvanized or stainless steel items.

SURFACE PREPARATION	1st & 2nd COAT	3rd & 4th COAT	5th COAT
As specified for each type of surface	MIL-DTL-24441 /19B	MIL-DTL-24441, SheetM8.03 & M8.13, or Color No. White	MPI 72 MIL-PRF-85285

-- End of Section --

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SECTION 10100A

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07/02

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## SECTION 10100A

VISUAL COMMUNICATIONS SPECIALTIES  
07/02

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1 (1984; R 1994) Safety Performance Specifications and Methods of Testing for Safety Glazing Materials Used In Buildings

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 221 (2000) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

ASTM B 221M (2000) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)

ASTM C 1048 (1997b) Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass

ASTM E 84 (2001) Surface Burning Characteristics of Building Materials

ASTM F 148 (1995) Binder Durability of Cork Composition Gasket Materials

ASTM F 152 (1995; R 2002) Tension Testing of Nonmetallic Gasket Materials

ASTM F 793 (1993; R 1998) Wallcovering by Durability Characteristics

## 1.2 GENERAL REQUIREMENTS

The term visual communication specialties when used herein shall include a recessed ceiling mounted display screen and recessed ceiling mounted video projector. All visual communication products shall be from manufacturer's standard product line.

## 1.2.1 Purchasing of Electronic Equipment

Due to advances in technology of electronic equipment, \$5,000 has been set aside for purchasing, as outlined in Section 00800. Therefore, specific manufacturers and makes of equipment are not specified herein. Contractor

shall be responsible for equipment purchase and installation. All electronic items to be purchased shall be submitted as a shop drawing for approval prior to purchase and installation. Purchase receipts of equipment and Contractor's installation cost (including profit & overhead) shall accompany the shop drawing submittal. Contractor will need to discuss with the Contracting Officer equipment to be purchase at least 6 months prior to occupancy date. Stereo equipment shall be located in cabinet provided in Room #102. The following is a list of anticipated items to be purchased:

- a. Visual projector- connected to computer and stereo.
- b. VCR player.
- c. Sound system- including recessed ceiling mounted speakers.
- d. DVD player.
- e. C/D player.
- f. Cassette deck.
- g. PreAmp processor stereo.
- h. Amplifier stereo.
- i. 27 inch television with stand (stand shall have wheels).

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### SD-03 Product Data

Visual Communication Specialties; G-DO

Manufacturer's descriptive data and catalog cuts.  
Manufacturer's installation instructions, and cleaning and maintenance instructions.

#### 07 Certificates

Visual Communication Specialties;

Certificate of compliance signed by Contractor attesting that visual communication products conform to the requirements specified.

### 1.4 DELIVERY, STORAGE AND HANDLING

Materials shall be delivered to the building site in the manufacturer's original unopened containers and shall be stored in a clean dry area with temperature maintained above 50 degrees F. Materials shall be stacked according to manufacturer's recommendations.

### 1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided.

## PART 2 PRODUCTS

### 2.1 MATERIALS

### 2.1.1 RECESSED MOUNTED PROJECTOR

The video projector and associative equipment shall be approved by the Contracting Officer and purchased by the Contractor 6 months before beneficial occupancy. Due to the rapid changes in technology for video projectors and other audio equipment, the Contractor shall set-aside an allowance of \$8,000 for the video projector, tape player, C/D player, speakers, 35mm slide viewer, electrical switches, electrical wiring, and other associative equipment (does not include the projector screen-associative electrical switches and wiring, and the "scissor" lift system).

Visual performance features of the video projector shall include the following; capable for slide presentations, C/D videos, VCR movies and visual/audio connection to the cable television system. Video project shall be installed above the finished acoustical tile ceiling on a "scissor" lift system- see paragraph below for additional information regarding the projector lift ("scissor") system and the recessed mounted projection screen.

#### 2.1.1.1 Projector Lift ("Scissor")

Projector shall be installed on a recessed ceiling "scissor" lift. The "scissor" lift shall allow the projector to be positioned in a minimum of 3 different positions (store, show and service). The "scissor" lift shall fit within a 23 inch by 23 1/2 inch opening, with capability of extended travel distances (5 feet above finished floor to a concealed position above the finished ceiling system). Operation is 115 volt, switching is a 12V. Lifting capacity shall be a minimum 350 pounds. Scissor lift shall be manufactured by Draper (1-765-987-7999), model SLX series- or equal. Lift shall include the ceiling trim kit with matching acoustical ceiling tile panel.

#### 2.1.1.2 RECESSED MOUNTED PROJECTION SCREEN

Recessed ceiling mounted motorized projection screen shall have 120V motor that is lubricated for life, quick reversal type, has overload protector, integral gears, and preset accessible limit switches. Recessed ceiling mounted projection screens shall have an operable closure door and access panel. Door panel shall have a baked enamel finish to match ceiling color.

Screen shall be flame retardant, mildew resistant, and white matte with white masking borders. Tab tensioned screens shall have a vinyl surface that is stretchable. Bottom of screen fabric shall be weighted with metal rod. Roller shall be a rigid metal at least 3 inches in diameter mounted on sound absorbing supports. Motor will be an end mounted design and installed above the finish ceiling. Screen shall have a 3 position control switch to stop or reverse screen at any point. The switch shall be installed in a flush electrical box with cover plate, location(s) as shown on the electrical drawings. All conduit and wiring from the control switch to the projection screen shall be furnished and installed by the Contractor. Ceiling recessed case shall be extruded aluminum. Ceiling mounted case shall be aluminum. Screen shall be UL listed. The size shall be approximately 12 feet (width) x 6 feet (height). Exact screen size shall be the Contractor's responsibility to coordinate actual projection screen size and installation with the video projector and the designated location.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Installation and assembly shall be in accordance with manufacturer's printed instructions. Concealed fasteners shall be used. Visual display boards shall be attached to the walls with suitable devices to anchor each unit. The Contractor shall furnish and install trim items, accessories and miscellaneous items in total, including but not limited to hardware, grounds, clips, backing materials, adhesives, brackets, and anchorages incidental to or necessary for a sound, secure, complete and finished installation. Installation shall not be initiated until completion of room painting and finishing operations. Visual display boards shall be installed in locations and at mounting heights indicated. Visual display boards shall be installed level and plumb, and if applicable doors shall be aligned and hardware shall be adjusted. Damaged units shall be repaired or replaced by the Contractor as directed by the Contracting Officer.

### 3.2 CLEANING

All equipment shall be cleaned in accordance with manufacturer's instructions.

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SECTION 10153

TOILET PARTITIONS

**08/02**

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## SECTION 10153

TOILET PARTITIONS  
08/02

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by basic designation only.

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191 (1998) ADA Accessibility Guidelines for -  
Buildings and Facilities

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-60003 (Basic) Partitions, Toilet, Complete

## 1.2 SYSTEM DESCRIPTION

Toilet partition system, including toilet enclosures, room entrance screens, and urinal screens, shall be a complete and usable system of panels, hardware, and support components. The Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS. The partition system shall be provided by a single manufacturer, and shall be a standard product as shown in the most recent catalog data. The partition system shall be as shown.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Toilet Partition System; G-DO

Drawings showing plans, elevations, details of construction, hardware, reinforcing, fittings, mountings, and anchoring.

## SD-03 Product Data

Toilet Partition System; G-DO

Manufacturer's technical data and catalog cuts including installation and cleaning instructions.

## SD-04 Samples

## Toilet Partition System; G-DO

Submit three samples of proposed color, minimum size 2" x 2".

## 1.4 DELIVERY, STORAGE, AND HANDLING

Components shall be delivered to the jobsite in the manufacturer's original packaging with the brand, item identification, and project reference clearly marked. Components shall be stored in a dry location that is adequately ventilated; free from dust, water, or other contaminants; and shall have easy access for inspection and handling.

## 1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

## PART 2 PRODUCTS

## 2.1 TOILET ENCLOSURES

Toilet enclosures shall conform to CID A-A-60003, Type I, Style A, floor supported. Width, length, and height of toilet enclosures shall be as shown. Finish surface of panels shall be painted metal, Finish 1. Panels indicated to receive toilet paper holders or grab bars as specified in Section 10800 TOILET ACCESSORIES, shall be reinforced for mounting of the items required. Grab bars shall withstand a bending stress, shear stress, shear force, and a tensile force induced by 250 lbf. Grab bars shall not rotate within their fittings.

## 2.2 URINAL SCREENS

Urinal screens shall conform to CID A-A-60003, Type III, Style A, floor supported. Finish surface of screens shall be painted metal, Finish 1. Width and height of urinal screens shall be as shown. Secure wall hung urinal screens with a minimum of three wall stirrup brackets.

## 2.3 HARDWARE

Hardware for the toilet partition system shall conform to CID A-A-60003 for the specified type and style of partitions. Hardware finish shall be highly resistant to alkalies, urine, and other common toilet room acids. Latching devices and hinges for handicap compartments shall comply with 36 CFR 1191 and shall be chrome-plated steel door latches that operate without either tight grasping or twisting of the wrist of the operator.

## 2.4 COLORS AND FINISHES

## 2.4.1 Colors

Color of finishes for toilet partition system components shall be as specified in Section 09915 COLOR SCHEDULE.

## 2.4.2 Finishes No. 1

Partitions, panels, screen, and door finishes shall conform to CID A-A-60003 and shall be Finish No. 1, baked enamel.

## PART 3 EXECUTION

## 3.1 INSTALLATION

Toilet partitions shall be installed straight and plumb with uniform clearance of 1/2 inch between pilasters and panels; 1 inch between pilasters and walls; and not more than 3/16 inch between pilasters and doors, in accordance with approved manufacturer's instructions with horizontal lines level and rigidly anchored to the supporting construction.

Where indicated, anchorage to walls shall be by toggle-bolting. Drilling and cutting for installation of anchors shall be at locations that will be concealed in the finished work. In the finished work, conceal evidence of drilling in floors and walls. Screws and bolts shall be stainless steel.

## 3.2 ADJUSTING AND CLEANING

Doors shall have a uniform vertical edge clearance of approximately 3/16 inch and shall rest open at approximately 30 degrees when unlatched. Baked enamel finish shall be touched up with the same color of paint that was used for the finish. Toilet partitions shall be cleaned in accordance with approved manufacturer's instructions and shall be protected from damage until accepted.

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01/97

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-- End of Section Table of Contents --

## SECTION 10270A

FIBERGLASS FLOOR GRATING  
01/97

## PART 1 GENERAL

## 1.1 SYSTEM DESCRIPTION

Fiberglass floor grating shall be installed at the locations shown on the drawings. The fiberglass grating shall be the standard product of a manufacturer specializing in the manufacture of molded fiberglass grating.

## 1.1.1 Grating Panel Strength

Molded fiberglass grating panels 1-inch deep shall have rectangular bars on a 1-inch by 4-inch rectangular grid. Panels 2-inches deep shall have rectangular bars at 2-inches on-centers in both directions. Grating shall be tested according to the 3-Point Load Test Method designed by the Fiberglass Grating Manufacturers Council (FGMC, Branch of the Society of Plastics, USA). Test panels of 1-inch deep grating shall have twelve bearing bars, 12-inches wide, and all sides open. Test panels of 2-inch deep grating shall have six bars, 12-inches wide, and all sides open. Test results shall be not less than indicated below:

	depth = 1-inch span = 24-inches	depth = 2-inches span = 36-inches
Max. deflection under 500 pound per foot line load on mid-span	0.24 inch	0.18 inch
Min. break point under concentrated line load at mid-span	5700 plf	7400 plf
Max. deflection under 240 psf uniform load	0.16 inch	0.14 inch

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-03 Product Data

## Fiberglass Grating Panels; G-A0

Manufacturer's descriptive data, catalog cuts, installation instructions, and certified copies of test reports.

### 1.3 DELIVERY, STORAGE, AND HANDLING

Materials shall be stored in original protective packaging in a safe, dry, and clean location and shall be handled in a manner to prevent damage.

### 1.4 EXTRA PANELS

Spare molded fiberglass grating panels shall be furnished at the rate of one panel for each 50 or fraction thereof required.

## PART 2 PRODUCTS

### 2.1 Materials

Glass content shall be a minimum of 37% made of corrosion resistant glass. Resin shall be one of the following types: Type V Vinyl Ester, Type I Isophthalic Polyester, or Type F Isophthalic Polyester. Resin shall have good corrosion resistance, and Flame Spread Rating Class 2 of 75 or less when tested in accordance with ASTM E84, and low smoke density.

### 2.2 Panel Construction

Panel size shall be of the lengths required to span over floor trenches as shown on the drawings, except that minor variations in length will be allowed if that will permit use of a manufacturer's standard panel. Panel widths shall be of the maximum such that the weight of each individual panel is less than 50 pounds. Panels shall have an anti-skid concave surface and shall have smooth surfaces with no exposed dry glass, voids, or cracks.

### 2.3 COLOR

Color shall be manufacturer's standard light gray or dark gray.

## PART 3 EXECUTION

### 3.1 INSTALLATION

The fiberglass floor grating shall be installed over floor trenches where shown on the drawings. Cutouts shall be provided where required for piping. Panels shall be cut with a heavy-duty rotary saw with either a masonry, carbide or diamond coated blade with the panel turned bottom side up. All cut edges shall be ground smooth using a coarse grit, open coated (resin) grinding disk. All cut surfaces shall be coated with a two-part resin system as recommended by the manufacturer to prevent corrosion of the glass fibers. Eye protection shall be worn while cutting panels. Adjacent panels shall be fastened together with type 316 stainless steel clips as recommended by the manufacturer.

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## DIVISION 10 - SPECIALTIES

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## EXTERIOR SIGNAGE

07/02

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## SECTION 10430

## EXTERIOR SIGNAGE

07/02

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## ALUMINUM ASSOCIATION (AA)

AA DAF-45 (1997) Designation System for Aluminum Finishes

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M (2000) Carbon Structural Steel

ASTM A 123/A 123M (2000) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 570/A 570M (1998) Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality

ASTM A 653/A 653M (2000) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A 924/A 924M (1999) General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

ASTM B 26/B 26M (1999) Aluminum-Alloy Sand Castings

ASTM B 62 (1993) Composition Bronze or Ounce Metal Castings

ASTM B 108 (1999) Aluminum-Alloy Permanent Mold Castings

ASTM B 209 (1996) Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B 221 (2000) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

## AMERICAN WELDING SOCIETY (AWS)

AWS C1.1M/C1.1 (2000) Recommended Practices for Resistance Welding

AWS D1.1/D1.1M (2000) Structural Welding Code - Steel

AWS D1.2 (1997) Structural Welding Code - Aluminum

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

## 1.2 GENERAL

All exterior signage shall be provided by a single manufacturer. Exterior signage shall be of the design, detail, sizes, types, and message content shown on the drawings, shall conform to the requirements specified, and shall be provided at the locations indicated. Signs shall be complete with lettering, framing as detailed, and related components for a complete installation. Recyclable materials shall conform to EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS.

## 1.3 WIND LOAD REQUIREMENTS

Exterior signage shall be designed to withstand a (1) one pound per square foot (psf) wind pressure.

## 1.4 CHARACTER PROPORTIONS AND HEIGHTS

Letters and numbers shall have a width-to-height ratio between 3:5 and 1:1 and a stroke-width-to-height ratio between 1:5 and 1:10. Characters and numbers on indicated signs shall be sized according to the viewing distance from which they are to be read. The minimum height is measured using an upper case letter "X".

## 1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

#### Approved Detail Drawings; G-AO

Drawings showing elevations of each type of sign; dimensions, details, and methods of mounting or anchoring; shape and thickness of materials; and details of construction. A schedule showing the location, each sign type, and message shall be included.

### SD-03 Product Data

#### Exterior Signage System; G-AO

Manufacturer's descriptive data and catalog cuts.

#### Installation; G-AO

Manufacturer's installation instructions and cleaning

instructions.

Wind Load Requirements; G-DO

Design analysis and supporting calculations performed in support of specified signage.

SD-04 Samples

Exterior Signs; G-AO

One 12 inch length sample for each type of sign. Each sample shall consist of a complete sign panel with letters and symbols. Samples may be installed in the work, provided each sample is identified and location recorded. Two samples of manufacturer's standard color chips for each material requiring color selection and 12 inch square sample of sign face color sample.

SD-10 Operation and Maintenance Data

Protection and Cleaning;

Two copies of maintenance instructions listing routine maintenance procedures and repairs.

## 1.6 QUALIFICATIONS

Signs, plaques, and dimensional letters shall be the standard product of a manufacturer regularly engaged in the manufacture of the products. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening.

## 1.7 DELIVERY AND STORAGE

Materials shall be wrapped for shipment and storage, delivered to the jobsite in manufacturer's original packaging, and stored in a clean, dry area in accordance with manufacturer's instructions.

## 1.8 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided.

## PART 2 PRODUCTS

### 2.1 EXTERIOR SIGNAGE SYSTEMS

Exterior signage shall consist of a free-standing post and panel type of exterior building identification sign and two building informational signs as shown on the drawings. Dimensions, details, materials, message content, and design of signage shall be as shown.

2.1.1 Type A. Free-Standing Post and Panel Type Sign (building identification).

2.1.1.1 Framing

Framing shall be an anodized aluminum framing tube columns welded to

companion plates. Mounting shall be provided as shown. Openings shall be sealed from moisture and made tamper-proof.

#### 2.1.1.2 Exterior Sheeting Panels

Panels shall be provided in sizes as shown on the drawings. Main sign panel shall be fabricated from a minimum of 0.125 inch thick aluminum. Raised signage panels shall be a 0.080 inch thick aluminum panel and anchored to the main sign panel. Panels shall be heliarc welded to framing system. Finish for metal panels shall be a Kynar 500, semi-gloss baked enamel. Paint colors shall be as shown on the drawings.

#### 2.1.1.3 Mounting

Mounting shall be provided by securing to concrete foundation as shown. Concrete foundation base shall be concealed with a cultured stone finish and a precast concrete cap as shown on the drawings.

#### 2.1.1.4 Finishes

The signage base finish shall be a cultured stone (identical to the building cultured stone requirements) as specified in SECTION: 04200 MASONRY. The precast concrete base cap shall be smooth with an acid etch finish (identical to the building precast trim units).

Signage background color shall be a semi-gloss baked-enamel finish with a Kynar 500 paint finish. Metal panel system finish shall have a baked enamel or two-component acrylic polyurethane coating.

#### 2.1.1.5 Illumination

Concealed lighting shall be provided within the signage framing as shown on the drawings. Lighting shall be controlled by a photocell device. Ballast and wiring within the sign shall be in metal raceways. Electrical equipment shall be UL or FM listed and comply with NFPA 70. Illumination shall be evenly distributed. An exterior switch located on the sign shall be provided to turn off power to the sign. Switch shall be readily accessible. See electrical drawings for additional information.

#### 2.1.1.6 Graphics

Signage graphics shall conform to the following:

Message shall be applied using the frisket method. Letters and graphic reveals shall have sharp edges in order to form distinct and crisp lines. Photomechanically reproduced graphic masks shall be applied to the sign face which has been coated with the graphics color. A background shall then be applied to the exposed surfaces. Handcut masks will not be accepted. Edges that are nicked, cut, or ragged will not be acceptable. A protective overcoat containing UV-resistant additives shall be applied.

#### 2.1.1.7 Messages

See drawings for message content. Typeface: Helvetica medium. Type size as indicated.

#### 2.1.2 Type B. Building Informational Signage- Cast Metal Plaque Signage Type ("Employee Entrance")

#### 2.1.2.1 Panels Cast Metal Plaque Signage

A non illuminated, dark bronze, cast aluminum plaque signage with raised letters shall be provided at the employee door entrance. The cast aluminum plaque sign shall be a minimum 0.125 thick with smooth edges and return. Signage lettering shall be provided as shown on drawings. Signage background shall have an etched textured finish to contrast with the smooth polished lettering finish. Panels shall be designed with metal return sheeting and shall have welded corners, ground smooth. Panel shall be heliarc welded to concealed wall mounted framing system.

#### 2.1.2.2 Finishes

Cast aluminum sign letters and plaque finish shall be a dark bronze anodized aluminum conforming to AA DAF-45.

#### 2.1.2.3 Mounting

Signage shall be permanently mounted to a steel frame anchored to the building structure.

#### 2.1.2.4 Lettering

Cast metal plaque signage lettering shall be a minimum 1/4- inch raised aluminum lettering. Lettering shall have the appearance of a precision cut letter cut from solid metal. Lettering face shall have a grounded smooth finish to contrast with the plaque background.

#### 2.1.3 Type C. Building Informational Signage- Cast Metal Plaque Logo Sign with Individual Cast Aluminum Letters ("Montana Fish, Wildlife & Parks")

##### 2.1.3.1 Cast Metal Plaque Logo Signage

A non illuminated, dark bronze, cast aluminum plaque signage with raised letters and graphics shall be provided at the facility main door entrance. The cast aluminum plaque sign shall be a minimum 0.125 thick with smooth edges and return. The logo signage shall be a minimum 3/4" raised graphical image with the Montana "bear" logo. Contractor shall be responsible to contact Montana Fish, Wildlife & Parks for specific graphic requirements (406-444-4952). Signage background shall have an etched textured finish for graphical emphasis. Panel shall be designed with metal return sheeting and shall have welded corners, ground smooth. Panel shall be heliarc welded to concealed wall mounted framing system.

##### 2.1.3.2 Lettering

Individual cast aluminum metal signage lettering shall be a minimum 3/4- inch raised from the exterior building surface. Lettering shall have the appearance of a precision cut letter cut from solid metal. Lettering face shall have a grounded smooth polished finish. A Helvetica Medium lettering style shall be provided as shown on the drawings. Letter size shall be as shown on the drawings. Installation of letters shall be a concealed anchorage. Letters shall be packaged for protection until installation.

#### 2.2 ALUMINUM ALLOY PRODUCTS

Aluminum alloy products shall conform to ASTM B 209 for sheet or plate, ASTM B 221 for extrusions and ASTM B 26/B 26M or ASTM B 108 for castings.

Aluminum extrusions shall be provided at least 1/8 inch thick and aluminum plate or sheet at least 16 gauge thick. Welding for aluminum products shall conform to AWS C1.1M/C1.1.

### 2.3 ANODIC COATING

Anodized finish shall conform to AA DAF-45 as follows:

Integrated color anodized designation AA-M10-C22-A32, Architectural Class 0.4 to 0.7 mil.

### 2.4 STEEL PRODUCTS

Structural steel products shall conform to ASTM A 36/A 36M. Sheet and strip steel products shall conform to ASTM A 570/A 570M. Welding for steel products shall conform to AWS D1.2.

### 2.5 CAST BRONZE

Components shall be fabricated with sharp corners, flat faces, and accurate profiles. Burrs and rough spots shall be removed and polished. Faces shall be finished to a uniform high luster. Cast bronze shall be in accordance with ASTM B 62.

### 2.6 ANCHORS AND FASTENERS

Exposed anchor and fastener materials shall be compatible with metal to which applied and shall match in color and finish and shall be non-rusting, non-corroding, and non-staining. Exposed fasteners shall be tamper-proof.

### 2.7 SHOP FABRICATION AND MANUFACTURE

#### 2.7.1 Factory Workmanship

Work shall be assembled in the shop, as far as practical, ready for installation at the site. Work that cannot be shop assembled shall be given a trial fit in the shop to ensure proper field assembly. Holes for bolts and screws shall be drilled or punched. Drilling and punching shall produce clean, true lines and surfaces. Welding to or on structural steel shall be in accordance with AWS D1.1/D1.1M. Welding shall be continuous along the entire area of contact. Exposed welds shall be ground smooth. Exposed surfaces of work shall have a smooth finish and exposed riveting shall be flush. Fastenings shall be concealed where practical. Items specified to be galvanized shall be by hot-dip process after fabrication if practical. Galvanization shall be in accordance with ASTM A 123/A 123M and ASTM A 653/A 653M, as applicable. Other metallic coatings of steel sheet shall be in accordance with ASTM A 924/A 924M. Joints exposed to the weather shall be formed to exclude water. Drainage and weep holes shall be included as required to prevent condensation buildup.

#### 2.7.2 Dissimilar Materials

Where dissimilar metals are in contact, or where aluminum is in contact with E.I.F.S., concrete, mortar, masonry, or absorptive materials subject to wetting, the surfaces shall be protected with a coat of asphalt varnish or a coat of zinc-molybdate primer to prevent galvanic or corrosive action.

#### 2.7.3 Shop Painting

Surfaces of miscellaneous metal work, except nonferrous metal, corrosion

resisting steel, and zinc-coated work, shall be given one coat of zinc-molybdate primer or an approved rust-resisting treatment and metallic primer in accordance with manufacturer's standard practice. Surfaces of items to be embedded in concrete shall not be painted. Upon completion of work, damaged surfaces shall be recoated.

## 2.8 COLOR, FINISH, AND CONTRAST

Color of products shall be in accordance with Section 09915 COLOR SCHEDULE and as noted on the drawings. Characters and symbols shall contrast with their background - either light characters on a dark background or dark characters on a light background.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Signs, plaques, and dimensional letters shall be installed in accordance with approved manufacturer's instructions at locations shown on the approved detail drawings. Circuits installed underground shall conform to the requirements of Section 16375A ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND. Steel conduits installed underground and illuminated signage mounted directly on buildings shall be in conformance with the requirements of Section 16528A EXTERIOR LIGHTING. Signs shall be installed plumb and true at mounting heights indicated, and by method shown or specified. Signs mounted on other surfaces shall not be installed until finishes on such surfaces have been completed.

#### 3.1.1 Anchorage

Anchorage and fastener materials shall be in accordance with approved manufacturer's instructions for the indicated substrate. Anchorage not otherwise specified or indicated shall include slotted inserts, expansion shields, and powder-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine carriage bolts for steel; lag bolts and screws for wood.

#### 3.1.2 Protection and Cleaning

The work shall be protected against damage during construction. Hardware and electrical equipment shall be adjusted for proper operation. Glass, frames, and other sign surfaces shall be cleaned in accordance with manufacturer's instructions. After signs are completed and inspected, the Contractor shall cover all project identification, directional, and other signs which may mislead the public. Covering shall be maintained until instructed to be removed by the Contracting Officer or until the facility is to be opened for business. Signs shall be cleaned, as required, at time of cover removal.

### 3.2 FIELD PAINTED FINISH

Miscellaneous metals and frames shall be field painted in accordance with Section 09900 PAINTING, GENERAL. Anodized metals, masonry, and glass shall be protected from paint. Finish shall be free of scratches or other blemishes.

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## SECTION 10440

## INTERIOR SIGNAGE

07/02

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 605 (1998) Voluntary Specification,  
Performance Requirements and Test  
Procedures for High Performance Organic  
Coatings on Aluminum Extrusions and Panels

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1 (1984; R 1994) Safety Performance  
Specifications and Methods of Test for  
Safety Glazing Materials Used in Buildings

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Detail Drawings; G-DO

Drawings showing elevations of each type of sign, dimensions, details and methods of mounting or anchoring, shape and thickness of materials, and details of construction. A schedule showing the location, each sign type, and message shall be included.

## SD-03 Product Data

Installation; G-DO

Manufacturer's descriptive data, catalogs cuts, installation and cleaning instructions.

## SD-04 Samples

Interior Signage; G-DO

One sample of sign types A, B, C and H showing typical quality and workmanship. The samples may be installed in the work, provided each sample is identified and location recorded.

Three samples of color chips for each material requiring color selection.

#### SD-10 Operation and Maintenance Data

Approved Manufacturer's Instructions; G-AO  
Protection and Cleaning

Six copies of operating instructions outlining the step-by-step procedures required for system operation shall be provided. The instructions shall include simplified diagrams for the system as installed. Six copies of maintenance instructions listing routine procedures, repairs, and guides shall be provided. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Each set shall be permanently bound and shall have a hard cover. The following identification shall be inscribed on the covers: the words "OPERATING AND MAINTENANCE INSTRUCTIONS", name and location of the facility, name of the Contractor, and contract number.

### 1.3 GENERAL

Interior signage shall be of the design, detail, sizes, and types shown on the drawings, shall conform to the requirements specified, and shall be provided at the locations indicated. Message content shall be as indicated in Signage Placement Schedule. Signs shall be complete with lettering, framing as detailed, and related components for a complete installation. Recyclable materials shall conform to EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS.

#### 1.3.1 Character Proportions and Heights

Letters and numbers shall have a width-to-height ratio between 3:5 and 1:1 and a stroke-width-to-height ratio between 1:5 and 1:10.

#### 1.3.2 Raised and Brailled Characters and Pictorial Symbol Signs (Pictograms)

Permanent letters and numbers shall be raised 1/32 inch upper case, sans serif or simple serif type and shall be accompanied with Grade 2 Braille. Raised characters shall be at least 5/8 inch in height, but no higher than 2 inches. The border dimension of the pictogram shall be 6 inches minimum in height.

### 1.4 QUALIFICATIONS

Signs, plaques, and dimensional letters shall be the standard product of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate signs that have been in satisfactory use at least 2 years prior to bid opening.

### 1.5 DELIVERY AND STORAGE

Materials shall be delivered to the jobsite in manufacturer's original packaging and stored in a clean, dry area in accordance with manufacturer's

instructions.

#### 1.6 EXTRA STOCK

The Contractor shall provide extra stock of the following: fifty diecut paper inserts for sign type A. Contractor shall provide source name, address, phone number, and ordering information for future replacement of diecut paper inserts.

### PART 2 PRODUCTS

#### 2.1 ROOM IDENTIFICATION/DIRECTIONAL SIGNAGE SYSTEM

Signs shall be fabricated of Type ES/MP laminated thermosetting plastic suitable for engraving or acrylic plastic conforming to ANSI Z97.1.

##### 2.1.1 Standard Room Signs

Signs shall consist of matte finish acrylic plastic or laminated thermosetting Type MP plastic. Units shall be frameless. Corners of signs shall be squared.

##### 2.1.2 Changeable Message Strip Signs

Changeable message strip signs shall consist of laminated thermosetting Type MP plastic with message slots as detailed, for insertion of changeable message strips. Size of signs shall be as shown on the drawings. Individual message strips to permit removal, change, and reinsertion shall be provided as detailed. Message strip shall consist of paper inserts composed of colored paper of sufficient weight and composition to support a laser printing process. Paper color shall match permanent text color. Text color for inserts shall be black. Paper shall be diecut or perforated to match holder size. Letter size shall be as shown on the drawings and text shall be provided as indicated in the Signage Schedule. Corners of signs shall be squared.

##### 2.1.3 Type of Mounting For Signs

Surface mounted signs shall be provided with 1/16 inch thick vinyl foam tape.

##### 2.1.4 Graphics

Signage graphics for modular identification/directional signs shall conform to the following:

Pressure sensitive prespaced and prealigned precision computer cut vinyl letters on release paper shall be provided. Edges and corners of finished letter forms and graphics shall be true and clean. Vinyl sheeting for graphics shall be 5 to 7 year premium type and shall be a minimum 0.003 inch film thickness. Film shall include a precoated pressure sensitive adhesive backing.

Message shall be applied to panel using the silkscreen process. Silkscreened images shall be executed with photo screens prepared from original art. Handcut screens will not be accepted. Original art shall be defined as artwork that is a first generation reproduction of the specified art. Edges and corners shall be clean.

Text for changeable message strip sign paper inserts shall be laser printed. Text content shall be coordinated with the Contracting Officer. Text and inserts shall be reproducible using the manufacturer's software package. Contractor shall supply one complete signage manufacturer's software package in User selected format (Macintosh, IBM PC, or IBM/Compatible PC type computer) enabling end user to produce replacement graphics on insert paper using user's laser printer.

Graphics shall be raised 1/32 inch with background painted with low VOC paint or engraved exposed laminate.

## 2.2 ORGANIC COATING

Organic coating shall conform to AAMA 605, with total dry film thickness not less than 1.2 mils.

## 2.3 FABRICATION AND MANUFACTURE

### 2.3.1 Factory Workmanship

Exposed surfaces of work shall have a smooth finish and exposed riveting shall be flush. Fastenings shall be concealed where practicable.

### 2.3.2 Dissimilar Materials

Where dissimilar metals are in contact, the surfaces will be protected to prevent galvanic or corrosive action.

## 2.4 COLOR, FINISH, AND CONTRAST

Color shall be in accordance with Section 09915 COLOR SCHEDULE. The characters and background of signs shall be eggshell, matte, or other non-glare finish. Characters and symbols shall contrast with their background - either light characters on a dark background or dark characters on a light background.

## 2.5 PRESSURE SENSITIVE LETTERS

Ensure that edges and corners of finished letterforms and graphics are true and clean. Do not use letterforms and graphics with rounded positive or negative corners, nicked, cut, or ragged edges.

### 2.5.1 Typeface

Helvetica medium.

### 2.5.2 Size

As indicated on drawings.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Signs shall be installed in accordance with approved manufacturer's instructions at locations shown on the detail drawings. Signs shall be installed plumb and true, and by method specified. Mounting height shall be 60 inches above the finish floor to the centerline of the sign. Signs

shall be installed on the wall adjacent to the latch side of the door. Where there is no wall space to the latch side of the door, including at double leaf doors, signs shall be placed on the nearest adjacent wall. Mounting location for such signage shall be so that a person may approach within 3 inches of signage without encountering protruding objects or standing within the swing of a door. Signs on doors or other surfaces shall not be installed until finishes on such surfaces have been installed.

Signs installed on glass surfaces shall be installed with matching blank back-up plates in accordance with manufacturer's instructions.

### 3.1.1.1 Signage Placement Schedule

<u>DOOR NO.</u>	<u>SIGN TYPE</u>	<u>ROOM NO.</u>	<u>PERMANENT MESSAGE</u>	<u>INSERT MESSAGE</u>	<u>SYMBOL</u>	<u>REMARKS</u>
102A	C	Note #8	Meeting Room A			Note #9
102C	C	Note #8	Meeting Room B			Note #9
104	B	Note #8	Vending			
105	B	Note #8	Break Room			
<u>DOOR NO.</u>	<u>SIGN TYPE</u>	<u>ROOM NO.</u>	<u>PERMANENT MESSAGE</u>	<u>INSERT MESSAGE</u>	<u>SYMBOL</u>	<u>REMARKS</u>
105A	B	Note #8	Employees Only			
106	B	Note #8	Hatchery Offices			
107	H	Note #8	Women		Handicapped Woman	
108	H	Note #8	Men		Handicapped Man	
111	B	111	Storage			
112	B	112	Chemical Storage			
114	H	Note #8	Mens Locker		Handicapped Man	
114A	H	Note #8	Mens Locker		Handicapped Man	Note #4
115	H	Note #8	Womens Locker		Handicapped Woman	
115A	H	Note #8	Womens Locker		Handicapped Woman	Note #4
120	B	120	Storage			

121	A	Note #8	Assistant Manager	Note #2		
122	B	145	Restricted Access			Note #3
123	A	Note #8	Manager	Note #2		
124	A	Note #8	Sleeping Quarter #1	Note #2		
127	B	Note #8	Temporary Crew Quarters			Note #6
127	B	Note #8	Hatchery Offices			Note #7
128	A	Note #8	Sleeping Quarter #2	Note #2		
131A	B	131	Crew Lounge and Kitchen			
<u>DOOR NO.</u>	<u>SIGN TYPE</u>	<u>ROOM NO.</u>	<u>PERMANENT MESSAGE</u>	<u>INSERT MESSAGE</u>	<u>SYMBOL</u>	<u>REMARKS</u>
134	B	134	Office and Wet Lab			
136	B	136	Isolation Area Restricted Access			
133	B	Note #8	Employee Access			Note #10

## Notes:

1. Permanent message text shall be coordinated with the Contracting Officer.
2. Insert message text shall be coordinated with the Contracting Officer.
3. Sign shall be located in room 122.
4. Sign shall be located in room 145.
5. Sign shall be located in room 106.
6. Sign shall be located in room 116.
7. Sign shall be located in room 127.
8. No room number required.
9. Sign shall have an "In Use/Not In Use" slider.
10. Sign shall be located in room 137.

## 3.1.2 Anchorage

Anchorage shall be in accordance with approved manufacturer's instructions.

Anchorage not otherwise specified or shown shall include slotted inserts, expansion shields, and powder-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine carriage bolts for steel; lag bolts and screws for wood. Exposed anchor and fastener materials shall be compatible with metal to which applied and shall have

matching color and finish. Where recommended by signage manufacturer, foam tape pads may be used for anchorage. Foam tape pads shall be minimum 1/16 inch thick closed cell vinyl foam with adhesive backing. Adhesive shall be transparent, long aging, high tech formulation on two sides of the vinyl foam. Adhesive surfaces shall be protected with a 5 mil green flatstock treated with silicone. Foam pads shall be sized for the signage as per signage manufacturer's recommendations. Signs mounted to painted gypsum board surfaces shall be removable for painting maintenance. Signs mounted to lay-in ceiling grids shall be mounted with clip connections to ceiling tees.

### 3.1.3 Protection and Cleaning

The work shall be protected against damage during construction. Hardware and electrical equipment shall be adjusted for proper operation. Glass, frames, and other sign surfaces shall be cleaned in accordance with the manufacturer's approved instructions.

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SECTION 10505N

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09/99

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## SECTION 10505N

## STEEL CLOTHING LOCKERS

09/99

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 653/A 653M	(1998) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B 456	(1995) Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
ASTM D 2092	(1995) Preparation of Zinc-Coated (Galvanized) Steel Surfaces for Painting

## U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS AA-L-00486	(Rev. J) Lockers, Clothing, Steel
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## 1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

## SD-02 Shop Drawings

Types; G-DO

Location; G-DO

Installation; G-AO

Numbering system; G-DO

## SD-03 Product Data

Material; G-DO

Finish; G-DO

Locker Components; G-DO

Assembly instructions; G-AO

## SD-04 Samples

Color chips; G-DO

Provide three samples of proposed color, minimum size 3" x 3".

### 1.3 DELIVERY, HANDLING, AND STORAGE

Deliver lockers and associated materials in their original packages, containers, or bundles bearing the manufacturer's name and the name of the material. Protect from weather, soil, and damage during delivery, storage, and construction.

### 1.4 FIELD MEASUREMENTS

To ensure proper fits, make field measurements prior to the preparation of drawings and fabrication.

### 1.5 QUALITY ASSURANCE

#### 1.5.1 Color Chips

Provide a minimum of three color chips, not less than 3 inches square, of each color scheduled.

## PART 2 PRODUCTS

### 2.1 TYPES

FS AA-L-00486. Provide Type I, single-tier and Type II, double-tier (as indicated on the drawings), Style- metal flush doors with standard top and bottom louvered vents, lockers in the location, quantities and sizes indicated. Provide locker finish color as scheduled.

### 2.2 MATERIAL

#### 2.2.1 Galvanized Steel Sheet

ASTM A 653/A 653M, commercial quality, minimized spangle, galvanized steel sheet with not less than G60 zinc coating. Prepare surface of sheet for painting in accordance with ASTM D 2092, Method A.

#### 2.2.2 Chromium Coating

Nickel and chromium electrodeposited on the specified base metal. Conform to ASTM B 456, SC-3, as applicable to the base metal.

#### 2.2.3 Finish

FS AA-L-00486.

##### 2.2.3.1 Color

Shall be as specified in Section 09915 Color Schedule.

### 2.3 COMPONENTS

#### 2.3.1 Built-In Locks

FS AA-L-00486. Provide built-in recessed combination locks.

### 2.3.2 Coat Hooks

FS AA-L-00486, chromium plated.

### 2.3.3 Hanger Rods

FS AA-L-00486.

### 2.3.4 Door Handles

FS AA-L-00486. Provide zinc alloy or steel handles with a chromium coating. Door handles shall be integral with the the recessed built-in combination locks.

### 2.3.5 Doors

FS AA-L-00486, not less than 0.0598 inch thick steel sheet.

#### 2.3.5.1 Hinges

In addition to the requirements of FS AA-L-00486, provide 5-knuckle hinges, minimum 2 inches high. Fabricate knuckle hinges from not less than 0.0747 inch thick steel sheet. A full height piano hinge may be provided if standard with the manufacturer. Weld or bolt hinges to the door frame. Weld, bolt, or rivet hinges to the door.

#### 2.3.5.2 Latching Mechanisms

FS AA-L-00486.

### 2.3.6 Latch Strikes

FS AA-L-00486. Fabricate from not less than 0.0747 inch thick steel sheet, except latch strike may be continuous from top to bottom and fabricated as part of the door framing.

### 2.3.7 Silencers

FS AA-L-00486.

### 2.3.8 Back and Side Panels, Tops, and Bottoms

FS AA-L-00486, not less than 0.0474 inch thick steel sheet.

### 2.3.9 Shelves

FS AA-L-00486. Fabricate from not less than 0.0598 inch thick steel sheet.

### 2.3.10 Number Plates

FS AA-L-00486. Brushed aluminum plate with 1/2" high black numeralsProvide consecutive numbers from one to end of sequence. Each toilet room locker set numerals shall start at one.

### 2.3.11 Fastening Devices

Provide bolts, nuts, and rivets as specified in FS AA-L-00486.

## PART 3 EXECUTION

### 3.1 ASSEMBLY AND INSTALLATION

Assemble lockers according to the locker manufacturer's instructions. Align lockers horizontally and vertically. Secure lockers to wall and base with screws as indicated. Bolt adjacent lockers together. Adjust doors to operate freely without sticking or binding and to ensure they close tightly. A continuous sloping metal top closure shall be provided over the entire locker area. End and top closure strips shall be provide as required to close the space between the lockers and wall. All closure strips and fillers shall be furnished and installed in accordance with the locker manufacturer's recommendations.

### 3.2 NUMBERING SYSTEM

Install number plates on lockers consecutively as directed by the Contracting Officer. Contractor shall provide all lock combination numbers and a minimum of 3 master keys to the Contracting Officer 1 month prior to beneficial occupancy.

### 3.3 FIELD QUALITY CONTROL

#### 3.3.1 Testing

Government may request performance-characteristic tests on assembled lockers in accordance with FS AA-L-00486. Lockers not conforming will be rejected.

#### 3.3.2 Repairing

Remove and replace damaged and unacceptable portions of completed work with new.

#### 3.3.3 Cleaning

Clean surfaces of the work, and adjacent surfaces soiled as a result of the work, in an approved manner. Remove equipment, surplus materials, and rubbish from the site.

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SECTION 10522

FIRE EXTINGUISHER CABINETS & EXTINGUISHERS

03/99

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## SECTION 10522

FIRE EXTINGUISHER CABINETS & EXTINGUISHERS  
03/99

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC SP 5 (1985) White Metal Blast Cleaning

SSPC SP 8 (1982) Pickling

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-03 Product Data

## Fire Extinguisher Cabinet; G-DO

Product data for each type of product specified. For fire extinguisher cabinets include rough-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type and materials, trim style, door construction, panel style and materials.

## SD-08 Manufacturer's Instructions

## Manufacturer's Installation Instructions;

## 1.3 QUALITY ASSURANCE

Coordinate with Contracting Officer to verify that fire extinguisher cabinets are sized to accommodate fire extinguishers provided by Government of type and capacity indicated.

## PART 2 PRODUCTS

## 2.1 MOUNTING BRACKETS

a. Fire Extinguisher Cabinet- (F.E.C.) Provide brackets in plated finish designed to prevent accidental dislodgement of extinguisher, for size required and capacity of extinguisher indicated.

b. Fire Extinguisher Bracket- (F.E.B.) Provide brackets for

extinguishers (extinguishers not located in cabinets) as indicated or required.

## 2.2 FIRE EXTINGUISHER CABINETS (F.E.C.)

Cabinets shall be a recessed style type and sized as shown on the drawings.

Cabinets located in fire-rated walls shall be fire-rated type, fabricated in accordance with ASTM E 814, and shall be listed by an approved testing agency for 1-hour combustible and non-combustible wall systems. Cabinets shall have the capability of securing the fire extinguisher to the cabinet. Box and trim shall be of heavy gauge rolled steel. Door shall be a rigid frame with full length piano type hinge and double strength (DSA) glass panel. Door shall not be equipped with a door locking device. Door and cabinet shall have manufacturer's standard baked-on enamel finish, inside and out of the cabinet. Final paint finish shall be in accordance with SECTION 09915 COLOR SCHEDULE.

Construction: Manufacturer's standard enameled steel box, with trim, frame, door, and hardware of type and style as follows:

Cabinet Type:	For semi-recessed installation in concrete masonry unit or steel stud/gypsum board walls as shown on drawings.
Trim Style:	One piece stainless steel with corners mitered, welded and ground smooth
Door Construction:	Manufacturer's standard, double strength glass type door with metal edge reinforcing at hinge and latch jambs
Door Hardware:	Either lever handle with cam action latch or door pull, exposed or concealed, and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees.

## 2.3 FIRE EXTINGUISHER BRACKETS (F.E.B.)

Fire extinguisher brackets shall be a manufacturer's standard bracket, which secures an extinguisher to the wall. The bracket shall have a minimum of two outer straps to secure the extinguisher to the bracket. Brackets shall have the manufacturer's standard baked-on red enamel finish. Install brackets where shown on the drawings.

## 2.4 FINISHES FOR FIRE EXTINGUISHER CABINETS, GENERAL

- a. Comply with NAAM "Metal Finishes Manual" for recommendations relative to application and designation of finishes.
- b. Protect mechanical finishes on exposed surfaces from damage by application of strippable, temporary protective covering prior to shipment.

## 2.5 STEEL FIRE EXTINGUISHER CABINET FINISH

### 2.5.1 Surface Preparation

Solvent-clean surfaces in compliance with SSPS SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill

scale and rust, if present, from uncoated steel in compliance with SSPC SP 5 (White Metal Blast Cleaning) or SSPC SP 8 (Pickling).

#### 2.5.2 Baked Enamel Finish

Manufacturer's standard two-coat baked enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's instructions for application and baking to achieve a minimum dry film thickness of 2.0 mils. Cabinet interior shall be high gloss white color.

#### 2.6 Fire Extinguishers

Contractor shall furnish and install a fire extinguisher at all fire extinguisher cabinet and bracket locations. Extinguisher shall be a portable, 10 pound, multi-purpose (ABC type), dry chemical extinguisher. Extinguisher shall be rechargeable. Extinguisher shall consist of a pull pin, upright squeeze grip operation, a discharge hose, and visual pressure gauge. Extinguisher material shall be non-toxic. Manufacturer's standard impact resistant epoxy finish and extinguisher type label shall be provided on the exterior cover of the extinguisher.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

- a. Install fire extinguisher cabinets and mounting brackets in locations indicated, at heights to comply with applicable regulations of governing authorities.
- b. Prepare recesses in walls for fire extinguisher cabinets as required by type and size of cabinet and style of trim, and to comply with manufacturer's instructions.
- c. Securely fasten mounting brackets and fire extinguisher cabinets to structure, square and plumb, to comply with manufacturer's instructions.

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SECTION 10650A

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08/00

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## SECTION 10650A

## OPERABLE PARTITIONS

08/00

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 84	(1999) Surface Burning Characteristics of Building Materials
ASTM E 90	(1999) Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions
ASTM E 413	(1987; R 1999) Rating Sound Insulation

## NATIONAL FIRE PROTECTION AGENCY (NFPA)

NFPA 265, UBC 8-2	Corner Burn Test
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## 1.2 GENERAL REQUIREMENTS

The Contractor shall supply and install flat wall, manual operation, acoustical operable partitions as shown on the drawings including all hardware, seals, track and rollers as needed to close the specified opening. The partition shall be made up of a series of rigid, flat wall panels; each panel being a one-piece assembly nominally 48 inches wide. Unless otherwise specified, the wall shall comprise the least number of panels. The mechanical seal of the panel shall actuate with a single operating action.

## 1.2.1 Manual Operation

The manual operation shall be accomplished with less than 20 lbf force to start movement at the rate of 3.33 ft/s (200 ft/min). A removable handle shall be used to extend and retract the bottom operable seals; vertical movement of seals shall be 2 inches. Closure to the lead wall shall be by use of a flexible bulb; final closing shall be accomplished by means of a lever exerting pressure against wall.

## 1.3 SUBMITTALS

All items designated with a G, including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal

review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Operable Partitions; G-DO

Drawings containing complete schematic diagrams and details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

SD-03 Product Data

Operable Partitions; G-DO

Manufacturer's descriptive data, performance charts, catalog cuts, and installation instructions.

SD-04 Samples

Operable Partitions; G-DO

Submit three color samples, minimum 3" x 3" in size, of specified surfaces and finishes to match those specified. Finish and color requirements shall not be limited to manufacturer's standard selections in order to meet these requirements.

SD-07 Certificates

Materials;  
Operable Partitions;

Certificate attesting that the materials meet the requirements specified and that partitions have specified acoustical and flame retardant properties, as determined by test.

SD-10 Operation and Maintenance Data

Operable Partitions; G-AO

Furnish six complete copies of operating instructions. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and operating features. Data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of the parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. Six complete copies of maintenance instructions explaining routine maintenance procedures including inspection, adjustments, lubrication, and cleaning. The instructions shall list possible breakdown, methods

of repair, and a troubleshooting guide.

#### 1.4 DELIVERY AND STORAGE

Materials shall be delivered to the jobsite in the manufacturer's original, unopened packages and shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

#### 1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 5 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site. Door and partition finishes shall have a Class A rating when tested in accordance with ASTM E 84.

##### 2.1.1 Acoustical Fabric Wallcovering

The acoustical fabric shall meet a Class A Flame Spread Rating in accordance with ASTM E 84 and pass the Corner Burn as per NFPA 265, UBC 8-2. Wallcovering shall weigh 23 ounces/linear yd. and be 100% solution dyed polyester with fusible clear latex backing. Acoustical fabric wallcovering shall be equal to Hufcor "HytexRib".

##### 2.1.2 Hardware

Operable partitions shall have manufacturer's standard hardware. Hardware shall be anodized aluminum with a natural finish, chrome plated or brass plated metal, or painted finish.

##### 2.1.3 Sweep Strips

Sweep strips shall be vinyl or other material which will not crack or craze with severe usage. Sweep strip shall control STC to the specified rating.

##### 2.1.4 Track

Track shall be recessed as shown and shall be of extruded aluminum or baked enamel finish steel. Track shall be manufacturer's standard product designed for the weight of the finished partition, including door. Track sections shall be provided in the maximum lengths practicable, not less than 6 feet long except for narrow doors and at ends of runs where short length is required. Suitable joint devices such as interlocking keys shall be provided at each joint to provide permanent alignment of track. Color for exposed track areas shall be in accordance with Section 09915 Color Schedule.

#### 2.2 OPERABLE PARTITIONS

Operable partitions shall consist of top hung ball bearing carriers which

support paired modular panels. Partition finish shall have a flame spread rating of not more than 25 in accordance with ASTM E 84.

#### 2.2.1 Panels

Panels shall be constructed of minimum 16 gauge thick steel frames with minimum 22 gauge thick face panels spot welded to the frame. Panels shall be not more than 4 feet wide, except for end closure panels, and shall be full height to track. Panels shall lock in place to form a stable, rigid partition; low profile hinges shall project 1/4 inch maximum from panel edge. Tackable reinforced wall panels shall be surfaced with wall fabric which wraps around the vertical panel edges without vertical trim. Panel thickness (4 inch nominal) and composition shall be designed to provide an STC rating of not less than 49 in accordance with ASTM E 90 and ASTM E 413.

Panel configuration shall be paired panels. The manually operated panel pairs shall automatically lock together in the extended position to form an integral sound partition. Panels shall have a vinyl sweep at the top seals which compress against the bottom of the top track and at the floor. Depending on manufacturer's standards, door pocket may need to be slightly adjusted (deviation from contract drawings- floor plan) as required to fit operable partition into door pocket.

#### 2.2.2 Pocket Doors

Pocket doors shall be a pair of wood doors, matching other wood doors throughout the facility. Pocket doors shall fit securely into the pocket opening as integral part of the wall and be compatible with the operable wall partition track and operations. Door sizes shall be as recommended by the operable door manufacturer. Contractor shall install metal door frame around the pocket door opening to ensure proper fit. Metal door frame shall match the other metal door frames style and color. Door shall be nonfire rated and shall be manually operated.

#### 2.2.3 Seals

Bottom seals shall consist of a vinyl sweep mechanical seal which will expand in place or shall be accomplished by using panels which can be lowered by a removable operating device. Vertical seal between panels shall be anodized, architectural grade, aluminum extrusion with vinyl sound seal.

#### 2.2.4 Communicating Door

A communicating door (pass door) shall be 3 foot width by 7 foot high. Door shall be of the same materials and thickness as the operable wall panels. Door shall be A.D.A. compliant with a friction roller latch. All door hardware shall be furnished with the door by the operable wall manufacturer. Door shall be located in a standard panel width and approximately 4 feet from the end wall as shown on the drawings.

### 2.3 COLOR

Color shall be in accordance with SECTION 09915 COLOR SCHEDULE.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Installation shall be in accordance with the manufacturer's approved

installation instructions.

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DIVISION 10 - SPECIALTIES

SECTION 10800

TOILET ACCESSORIES

07/02

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## SECTION 10800

TOILET ACCESSORIES  
07/02

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 1036 (1991; R 1997) Flat Glass

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-03 Product Data

Finishes; G-DO  
Accessory Items; G-DO

Manufacturer's descriptive data and catalog cuts indicating materials of construction, fasteners proposed for use for each type of wall construction, mounting instructions, operation instructions, and cleaning instructions.

## SD-04 Samples

Finishes; G-DO  
Accessory Items; G-DO

One sample of each accessory proposed for use. Approved samples may be incorporated into the finished work, provided they are identified and their locations noted.

## SD-07 Certificates

Accessory Items

Submit for each type of accessory specified, attesting that the items meet the specified requirements.

## SD-10 Operation and Maintenance Data

Electric Hand Dryer; G-DO

Complete copies of maintenance instructions listing routine maintenance procedures and possible breakdowns and repairs. Instructions shall include simplified wiring and control diagrams and other information necessary for unit maintenance.

### 1.3 DELIVERY, STORAGE, AND HANDLING

Toilet accessories shall be wrapped for shipment and storage, delivered to the jobsite in manufacturer's original packaging, and stored in a clean, dry area protected from construction damage and vandalism.

### 1.4 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

## PART 2 PRODUCTS

### 2.1 MANUFACTURED UNITS

Toilet accessories shall be provided where indicated in accordance with paragraph SCHEDULE. Porcelain type, tile-wall accessories are specified in Section 09310 CERAMIC TILE. Each accessory item shall be complete with the necessary mounting plates and shall be of sturdy construction with corrosion resistant surface.

#### 2.1.1 Anchors and Fasteners

Anchors and fasteners shall be capable of developing a restraining force commensurate with the strength of the accessory to be mounted and shall be suited for use with the supporting construction. Exposed fasteners shall be of tamperproof design and shall be finished to match the accessory.

#### 2.1.2 Finishes

Except where noted otherwise, finishes on metal shall be provided as follows:

<u>Metal</u>	<u>Finish</u>
Stainless steel	No. 4 satin finish
Carbon steel, copper alloy, and brass	Chromium plated, bright

### 2.2 ACCESSORY ITEMS

Accessory items shall conform to the requirements specified below.

#### 2.2.1 Grab Bar (GB)

Grab bar shall be 18 gauge, 1-1/4 inches OD Type 304 stainless steel. Grab bar shall be form and length as indicated on the drawings. Concealed mounting flange shall have mounting holes concealed. Grab bar shall have peened non-slip surface. Installed bars shall be capable of withstanding a 500 pound vertical load without coming loose from the fastenings and without obvious permanent deformation. Space between wall and grab bar

shall be 1-1/2 inch.

#### 2.2.2 Mirrors, Glass (MG)

Glass for mirrors shall be Type I transparent flat type, Class 1-clear. Glazing Quality q1 1/4 inch thick conforming to ASTM C 1036. See SECTION: 08810A for mirror glass requirements.

#### 2.2.3 Paper Towel Dispenser (PTD)

Paper towel dispenser shall be constructed of not less than 0.269 inch Type 304 stainless steel, and shall be surface mounted. Dispenser shall have a towel compartment. A non-keyed locking mechanism shall provide easy access to paper towels.

#### 2.2.4 Sanitary Napkin Disposer (SND)

Sanitary napkin disposal shall be constructed of Type 304 stainless steel with removable leak-proof receptacle for disposable liners. Fifty disposable liners of the type standard with the manufacturer shall be provided. Receptacle shall be retained in cabinet by tumbler lock. Disposer shall be provided with a door for inserting disposed napkins, and shall be partition mounted, double access.

#### 2.2.5 Shower Curtain (SC)

Shower curtain shall be sized to suit conditions. Curtain shall be anti-bacterial nylon/vinyl fabric. Color shall be as shown in Section 09915 COLOR SCHEDULE.

#### 2.2.6 Shower Curtain Rods (SCR)

Shower curtain rods shall be Type 304 stainless steel 1-1/4 inch OD by 0.049 inch minimum straight to meet installation conditions.

#### 2.2.7 Soap Dispenser (SD)

Soap dispenser shall be lavatory mounted, liquid type consisting of a polyethylene tank with a minimum 32 fluid ounces holding capacity and a 6 inch spout length.

#### 2.2.8 Shelf, Metal, Heavy Duty (SMHD)

Heavy duty metal shelf shall be minimum of 18 gauge stainless steel with hemmed edges. Shelves over shall be provided with intermediate supports. Shelving shall be integrated with the mop rack (MR) holder.

#### 2.2.9 Towel Bar (TB)

Towel bar shall as specified in SECTION: 09310.

#### 2.2.10 Robe Hook (RH)

Robe hook shall as specified in SECTION: 09310.

#### 2.2.11 Toilet Tissue Dispenser (TTD)

Toilet tissue holder shall be Type II - surface mounted with two rolls of standard tissue mounted horizontally. Cabinet shall be stainless steel,

satin finish.

#### 2.2.12 Locker Room Wooden Benches (WB)

Locker room wooden benches shall be both free standing and wall mounted units. Wooden slats shall be made from selected hardwood (3" x 1 1/4" slat) and secured with round headed screws. Bench sizes shall be as indicated on the drawings. Wooden bench seat for the free standing bench shall be manufacturer's standard height, approximately 17 to 18 inches above finish floor. All benches shall be securely bolted and anchored to the floor and/or wall. Steel supports shall have a minimum two coat painted finish as specified in SECTION: 09900. Steel support shall be a tubular or round steel pipe with a minimum size of 2" x 2" x 1/4" (tubular) or 2 1/2" diameter (pipe) in size. Contractor shall furnish and install all wooden benches shall of the heavy duty type standard with the bench manufacturer.

#### 2.2.13 Toilet Seat Cover Dispenser (TSCD)

Toilet seat cover dispensers shall be Type 304 stainless steel and shall be surface mounted. Dispenser shall have a minimum capacity of 500 seat covers.

#### 2.2.14 Bathroom Tub Seat (BTS)

Bathroom wall mounted folding bathtub seat shall be installed in Room #130 bathtub. Seat shall be a stainless steel frame with 1/2" thick, solid phenolic, ivory colored seat. Seat is one piece and hinged onto the shower wall. Seating shall have the capability of being lowered into the horizontal position and be supported with the bathtub wall. Seat shall folding into a locking vertical position against the wall. Shower seat shall comply with ADA Accessibility Guideline requirements.

#### 2.2.15 Electric Hand Dryer (EHD)

Electric hand dryer shall be wall mounted and shall be designed to operate on 110/125 volts, 60 cycle, single phase alternating current with a heating element core rating of not more than 2100 watts. Dryer housing shall be of single piece construction and shall be chrome plated steel.

#### 2.2.16 Handicap Shower Seat (HSS)

Wall mounted folding shower seat with stainless steel frame. Seat is one piece with self-locking mechanism. Seat shall have an off-white sponge cushion seat cover. Shower seat shall comply with ADA Accessibility Guideline requirements.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Surfaces of fastening devices exposed after installation shall have the same finish as the attached accessory. Exposed screw heads shall be oval. Install accessories at the location and height indicated. Protect exposed surfaces of accessories with strippable plastic or by other means until the installation is accepted. After acceptance of accessories, remove and dispose of strippable plastic protection. Coordinate accessory manufacturer's mounting details with other trades as their work progresses. Brackets, plates, anchoring devices and similar items used for mounting

accessories in showers shall be bedded in a silicone or polysulphide sealant as they are set to provide a watertight installation. After installation, thoroughly clean exposed surfaces and restore damaged work to its original condition or replace with new work.

#### 3.1.1 Recessed Accessories

Fasten accessories with wood screws to studs, blocking or rough frame in wood construction. Set anchors in mortar in masonry construction. Fasten to metal studs or framing with sheet metal screws in metal construction.

#### 3.1.2 Surface Mounted Accessories

Mount on concealed backplates, unless specified otherwise. Accessories without backplates shall have concealed fasteners. Unless indicated or specified otherwise, install accessories with sheet metal screws or wood screws in lead-lined braided jute, teflon or neoprene sleeves, or lead expansion shields, or with toggle bolts or other approved fasteners as required by the construction. Install backplates in the same manner, or provide with lugs or anchors set in mortar, as required by the construction. Fasten accessories mounted on gypsum board and plaster walls without solid backing into the metal or wood studs or to solid wood blocking secured between wood studs, or to metal backplates secured to metal studs.

### 3.2 CLEANING

Material shall be cleaned in accordance with manufacturer's recommendations. Alkaline or abrasive agents shall not be used. Precautions shall be taken to avoid scratching or marring of surfaces.

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SECTION 11211A

PUMPS: WATER, CENTRIFUGAL (Pumps 3A/3B)

12/88

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## SECTION 11211A

PUMPS: WATER, CENTRIFUGAL (Pumps 3A/3B)  
**12/88**

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123/A 123M	(1997ael) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(1998) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 307	(1997) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM D 975	(1998b) Diesel Fuel Oils

## ASME INTERNATIONAL (ASME)

ASME B1.1	(1989) Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B16.1	(1998) Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.5	(1996; B16.5a) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

47 CFR 15	Radio Frequency Devices
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## HYDRAULIC INSTITUTE (HI)

HI 1.1-1.5	(1994) Standards for Centrifugal Pumps
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## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(1998) Motors and Generators
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## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 20	(1996; Errata Oct 1996; TIA 96-1)
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## Installation of Centrifugal Fire Pumps

- NFPA 30 (1996; Errata; TIA 96-2) Flammable and Combustible Liquids Code
- NFPA 37 (1998) Installation and Use of Stationary Combustion Engines and Gas Turbines
- NFPA 70 (1999) National Electrical Code

## THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

- SSPC Paint 21 (1991) White or Colored Silicone Alkyd Paint
- SSPC Paint 25 (1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (Without Lead and Chromate Pigments)

## UNDERWRITERS LABORATORIES (UL)

- UL 448 (1994; Rev thru May 1999) Pumps for Fire-Protection Service

## 1.2 GENERAL REQUIREMENTS

## 1.2.1 Standard Products

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate equipment that has been in satisfactory waterworks operation at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the jobsite. Pumps and, motors of the same types shall each be the product of one manufacturer.

## 1.2.2 Description

The pumps shall be horizontal centrifugal water pumps of the types indicated and specified. The single driving units for the pumps shall be electric motors.

## 1.2.3 Safety Requirements

Gears, couplings, projecting set-screws, keys, and other rotating parts, so located that any person can come in close proximity thereto, shall be fully enclosed or properly guarded.

## 1.2.4 Nameplates

Pumps and motors shall have a standard nameplate securely affixed in a conspicuous place showing the manufacturer's name, address, type or style, model, serial number, and catalog number. In addition, the nameplate for each pump shall show the capacity in gpm at rated speed in rpm and head in feet of water. Nameplate for each electric motor shall show at least the minimum information required by 10.38 NEMA MG 1. Such other information as the manufacturer may consider necessary to complete identification shall be shown on the nameplate.

#### 1.2.5 Electrical Work

Electrical motor driven equipment specified herein shall be provided complete with motors, motor starters, and controls. Electric equipment and wiring shall be in accordance with Section 16415 ELECTRICAL WORK, INTERIOR.

Electrical characteristics shall be as indicated. Motor starters shall be provided complete with properly sized thermal overload protection in each phase and other appurtenances necessary for the motor control specified. Each motor shall be of sufficient capacity to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor when operating at proper electrical system voltage and frequency. Manual or automatic control and protective or signal devices required for the operation herein specified and any control wiring required for controls and devices but not shown on electrical plans shall be provided under this section of the specifications.

#### 1.2.6 Selection Criteria

Pumps shall be designed using hydraulic criteria based upon actual model developmental test data. Pumps shall be selected at a point within the maximum efficiency for a given impeller casing combination. Deviations within 3 percent of maximum efficiency are permissible, provided the lesser efficiency is not less than the scheduled efficiency. Pumps having impeller diameters larger than 90 percent of the published maximum diameter of the casing or less than 15 percent larger than the published minimum diameter of the casing will be rejected. Acceptable maximum impeller diameter calculations shall not be based on percentage of impeller diameter range for a given casing.

#### 1.2.7 Conformance With Agency Requirements

Where materials or equipment are specified to be an approved type, the seal or label of approval from a nationally recognized testing agency, adequately equipped and competent to perform such services, shall be attached thereto. A written certificate from the testing agency shall accompany the materials or equipment and shall be submitted to the Contracting Officer stating that the items have been tested and that they conform to the applicable requirements of the specifications and to the standards listed herein. The certificate shall indicate the methods of testing used by the testing agency. In lieu of a certificate from a testing agency, published catalog specification data, accompanied by the manufacturer's certified statement to the effect that the items are in accordance with the applicable requirements of the specifications and the referenced standards, will be considered by the Contracting Officer and may be acceptable as evidence that the items conform with agency requirements.

#### 1.2.8 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing the work.

#### 1.2.9 Factory Tests

Pumps shall be tested by the manufacturer or a nationally recognized testing agency in compliance with Hydraulic Institute Standards. Where two or more identical pumps are specified, only one representative pump shall be tested. Certified test results shall be submitted to the Contracting

Officer.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

##### Installation; G-DO

Drawings containing complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation. A complete listing of equipment and materials shall be provided.

#### SD-03 Product Data

##### Materials and Equipment; G-DO

Manufacturer's descriptive data and technical literature, performance charts and curves for all impeller sizes for a given casing, catalog cuts, and installation instructions. Spare parts data for each different item of material and equipment specified, after approval of the detail drawings and not later than 2 months prior to the date of beneficial occupancy. Data shall include a complete list of parts and supplies, with current unit prices and source of supply.

##### Instructions; G-AO

Proposed diagrams, instructions, and other sheets, prior to posting. Approved wiring and control diagrams showing the complete layout of the entire system, including equipment, piping valves, and control sequence, framed under glass or in approved laminated plastic, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams, and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the systems.

#### SD-06 Test Reports

##### Tests; G-AO

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

## SD-10 Operation and Maintenance Data

## Centrifugal Pump System; G-AO

Six complete sets of instructions containing the manufacturer's operating and maintenance instructions for each piece of equipment. One complete set at the time the tests procedure is submitted; remaining sets before the contract is completed. Each set shall be permanently bound and shall have a hard cover. The following identification shall be inscribed on the covers: the words "OPERATING AND MAINTENANCE INSTRUCTIONS," name and location of the building, name of the Contractor, and contract number. Flysheets shall be placed before instructions covering each subject. Instruction sheets shall be approximately 8-1/2 by 11 inches, with large sheets of drawings folded in. Instructions shall include, but not be limited to, the following:

- a. System layout showing piping, valves, and controls.
- b. Approved wiring and control diagrams.
- c. A control sequence describing startup, operation, and shutdown.
- d. Operating and maintenance instructions for each piece of equipment, including lubrication instructions and troubleshooting guide.
- e. Manufacturer's bulletins, cuts, and descriptive data; and parts list and recommended spare parts.

## 1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

## PART 2 PRODUCTS

## 2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall be as specified below and as shown, and shall be suitable for the service intended. Materials and equipment shall be new and unused, except for tests. Where two or more pieces of equipment performing the same function are required, they shall be duplicate products of the same manufacturer.

## 2.2 CENTRIFUGAL WATER PUMPS

The pumps shall be the centrifugal type, designed for waterworks service in the following configurations:

	Pump No.
Horizontal	3A and 3B

## 2.2.1 Pump Service

The pumps shall be utilized to transfer water from the treated water storage tank, through the heat exchanger equipment, and ultimately into Tank 4, Heated Water Storage.

#### 2.2.2 Pump Drives

The pumps shall have variable speed, electric motor driving units and shall be directly connected to the driving units through solid shafts, flexible couplings, or free wheeling clutches.

#### 2.2.3 Pump Construction

Except as below specified, centrifugal water pumps shall be constructed in accordance with the Hydraulic Institute HI 1.1-1.5.

#### 2.2.4 Pump Characteristics

The pumps shall be capable of discharging quantities at total discharge heads measured at the discharge flange, between the following limits:

Pump  
No's.

3A and 3B	500 gpm at maximum pump output, with the capability to reduce output up to 70% less than maximum flow (to 150 gpm). Maximum total dynamic head (in feet water) is 72 feet TDH.
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Pumps shall operate at optimum efficiencies to produce the most economical pumping system under the conditions encountered. Pumps shall furnish not less than 150 percent of rated capacity at a total discharge head of not less than 65 percent of total rated head.

#### 2.2.5 Pump Casings

Pump casings shall be cast iron, or as recommended by the pump manufacturer, of the following design:

Horizontal shaft, horizontal split casing	Pump Nos.  3A and 3B
--	----------------------------

The casings shall be designed to permit replacement of wearing parts. Horizontal-split casings shall have the suction and discharge nozzles cast integrally with the lower half, so that the upper part of the casings may be removed for inspection of the rotating parts without disturbing pipe connections or pump alignment. Pump casings shall be of uniform quality and free from blowholes, porosity, hard spots, shrinkage defects, cracks and other injurious defects. Defects in casings shall not be repaired except when such work is approved and is done by or under the supervision of the pump manufacturer, and then only when the defects are small and do not adversely affect the strength or use of the casing. Casings shall be single or double volute with flanged piping connections conforming to ASME B16.1, Class 125. The direction of shaft rotation shall be conspicuously

indicated. The casing shall have tapped openings for air venting, priming, draining, and suction and discharge gauges. A brass or bronze umbrella or vent cock shall be furnished for venting except where automatic air vents are indicated. Drain openings in the volute, intake, or other passages capable of retaining trapped water shall be located in the low point of such passages.

#### 2.2.6 Impellers

Impellers shall be of enclosed design and shall be constructed of bronze or cast iron, carefully finished with smooth water passageways, and shall be statically and dynamically balanced. Impellers shall be securely keyed to the pump shaft.

#### 2.2.7 Wearing Rings

Wearing rings of bronze shall be provided for impellers. Wearing rings of a different composition or of a suitable ferrous material shall be provided for pump casings. Casing rings shall be securely fixed in position to prevent rotation. Rings shall be renewable and designed to ensure ease of maintenance.

#### 2.2.8 Shaft

Shaft shall be of high grade steel, accurately machined, and shall be of sufficient size and strength to perform the work required. Bronze renewable shaft sleeves shall be provided for protection of the shaft in contact with water, and in the stuffing boxes. Shaft sleeves shall be keyed to the pump shaft.

#### 2.2.9 Mechanical Seals

Mechanical seals shall be balanced or unbalanced, as necessary to conform to specified service requirements. Mechanical seals shall be constructed in a manner and of materials particularly suitable for the temperature service range and quality of water being pumped. Seal construction shall not require external source cooling for pumped-fluid service temperatures up to 250 degrees F. Seal pressure rating shall be suitable for maximum system hydraulic conditions. Materials of construction shall include AISI 300 series stainless steel, solid tungsten-carbide rotating-seal face, and Buna-N vinylidene-fluoride-hexafluoropropylene, EPT, or tetrafluoroethylene seals. Bypass flushing water supply shall be free of iron rust products and other abrasive materials and shall be directed onto face of seal without dead ending. All piping and accessories shall be provided. Throttling bushing shall have clearances to minimize leakage in case of complete seal failure without restriction of flushing water. Mechanical seals shall not be subjected to hydrostatic test pressures in excess of the manufacturer's recommendations.

#### 2.2.10 Couplings

Couplings shall be of the heavy-duty flexible type, keyed and locked to the shaft. The outside surface of the couplings for horizontal pumps shall be machined parallel to the axis of the shaft. The faces of the couplings shall be machined perpendicular to the axis of the shaft. Disconnecting the couplings shall be accomplished without removing the driver half or the pump half of the couplings from the shaft. Flexible couplings shall not be used to compensate for misalignment of pump.

### 2.2.11 Balance

All rotating parts of the equipment shall operate throughout the required range without excessive end thrust, vibration, or noise. Defects of this type that cannot be eliminated by installation adjustments will be sufficient cause for rejection of the equipment. Pump impeller assemblies shall be statically and dynamically balanced to within 1/2 percent of  $W$  times  $R$  squared, where  $W$  equals weight and  $R$  equals impeller radius. Shaft construction shall be substantial to prevent seal or bearing failure due to vibration. Total shaft peak-to-peak dynamic deflection measured by vibrometer at pump-seal face shall not exceed 2.0 mils under shutoff-head operating conditions. Flow from 1/4 inch iron pipe size (ips) pipe shall be provided during testing.

### 2.2.12 Bearings

Bearings shall be ball or roller type, and the main bearings shall take all radial and end thrust. Pumps that depend only on hydraulic balance to overcome end thrust will not be acceptable.

### 2.2.13 Lubrication

Bearings on horizontal-shaft pumps shall be either oil-bath type or grease type. Each oil reservoir shall be liberal in size and provided with an opening for filling, an overflow opening at the proper location to prevent overfilling, an oil-level sight glass, and a drain at the lowest point. Grease type bearings shall be provided with fittings for a grease gun and, if the bearings are not easily accessible, with grease tubing extending to convenient locations. The grease fittings shall be of a type that prevent over lubrication and the buildup of pressure injurious to the bearings.

### 2.2.14 Base Plates

Horizontal-shaft centrifugal pumps shall be provided with a common base for mounting each pump and driving unit of the pump on the same base. Each base shall be constructed of cast iron with a raised lip tapped for drainage, or of welded steel shapes with suitable drainage pan. The drainage structure shall collect the packing box leakage and shall have a 1/2 inch NPT connection to connect it to a drain.

### 2.2.15 Cocks, Plugs, and Accessories

The pumps shall be equipped with air cocks, drain plugs, and single gauges indicating discharge pressures for all pumps and suction pressures for pumps without suction lift. Gauges, equipped with a shutoff cock and snubber, shall conform to ASME B40.1, and shall be calibrated in pounds per square inch in not more than 2 psi increments. Gauge ranges shall be appropriate for the particular installation. Normal operating suction and discharge pressures of the pump shall be indicated on the mid-point range of the gauges.

### 2.2.16 Piping Connections

The pump suction and discharge shall be provided with flanged connections of suitable size and suitably arranged for piping shown. Pipe flanges shall conform to ASME B16.1 and ASME B16.5. Piping shall be installed to preclude the formation of air pockets.

### 2.2.17 Finish

Pump shall have painted or enameled finish as is standard with the manufacturer.

### 2.3 ELECTRICAL EQUIPMENT

Electrical equipment shall conform to Section 16415 ELECTRICAL WORK, INTERIOR. Electrical motor driven equipment herein specified shall be provided complete with motors, motor starters, and controls. Motor controls, equipment, and wiring shall be in accordance with NFPA 70.

#### 2.3.1 Electric Motors

Each electric motor-driven pump shall be driven by a continuous-duty electric motor. Motors shall have normal-starting-torque and low-starting-current characteristics, and shall be of sufficient size so that the nameplate horsepower rating will not be exceeded throughout the entire published pump characteristic curve. Motor bearings shall provide smooth operations under the conditions encountered for the life of the motor. Adequate thrust bearing shall be provided in the motor to carry the weight of all rotating parts plus the hydraulic thrust under variable pumping head conditions specified. Motors shall be rated 460 volts, 3 phase, 60 Hz and such rating shall be stamped on the nameplate.

#### 2.3.2 Control Equipment

Automatically controlled pumps shall have three-position "MANUAL-OFF-AUTOMATIC" selector switch in cover. Additional controls or protective devices shall be as indicated.

#### 2.3.3 Variable Speed Controls

The variable speed motor controller shall convert 460 volt plus 15 percent, minus 5 percent, three phase, 60 Hz (plus or minus 2 Hz) utility power to adjustable voltage/frequency, three phase, ac power for stepless motor control from 5 percent to 105 percent of base speed.

##### 2.3.3.1 Description

The variable speed drive shall produce an adjustable ac voltage/frequency output for complete motor speed control. The variable speed drive shall be automatically controlled by a grounded electronic control signal. The variable speed drive shall be self contained, totally enclosed in a NEMA MG 1 ventilated cabinet and capable of operation between 32 and 104 degrees F.

The variable speed drive maximum output current rating shall be equal to or exceed the motor nameplate full load. The manufacturer shall advise the maximum recommended motor sine wave current for each controller rating. Variable speed drive multiple motor operation at same frequency/speed shall be possible as long as the sum of connected motor full load sine wave currents are less than or equal to the variable speed drive maximum continuous current rating. Variable speed drive shall be 95 percent efficient at 100 percent rated output power, 60 Hz.

##### 2.3.3.2 Governing Requirements

Variable speed drives shall conform to the following requirements:

- a. Variable speed drive shall comply with 47 CFR 15 regulation of RF1/EM1 emission limits for Class A computing devices. The FCC

label of compliance shall be displayed on the variable speed drive.

- b. The variable speed drive and options shall comply with the applicable requirements and the standards of the American National Standards Institute (ANSI).
- c. Variable speed drive and option design and construction thereof shall comply with all applicable provisions of NFPA 70, Article 43D, Sections A-L.

#### 2.3.3.3 Quality Assurance

To ensure quality the variable speed drive shall be subject to the following tests:

- a. The integrated circuits shall undergo a 160-hour "burn-in" to test reliability. During the "burn-in" the temperature shall be cycled between 32 and 158 degrees F.
- b. The completed unit shall undergo a fully loaded 24-hour "burn-in."
- c. The unit shall be subject to a series of in-plant quality controlled inspections before approval for shipment from manufacturer's facilities.

#### 2.3.3.4 Service

The variable speed drive shall be supplied with the following:

- a. One-year parts and labor warranty.
- b. A troubleshooting guide to help the building operator determine what steps must be taken to correct any problem that may exist in the system.

#### 2.3.3.5 Basic Features

The variable speed drive shall have the following basic features:

- a. Hand/Off/Auto Operation.
- b. Manual/Auto speed reference switch.
- c. Minimum/maximum adjustable speeds.
- d. Speed potentiometer.
- e. Auto restart.
- f. Linear timed acceleration and deceleration for soft starting/stopping.
- g. 3-63 Hz controlled speed range. (Factory set at 15 Hz minimum).
- h. Terminal connections for time clock control, fire, smoke, freeze detectors, and EP relay pre-set speed override.
- i. Output frequency terminals for remote metering.

#### 2.3.3.6 Protective Circuits and Features

The variable speed drive controller shall include the following protective circuits/features:

- a. Current limits to 100 percent design by slowing down motor.
- b. Instantaneous Electronic Trip - automatically shutdown motor if current exceed 120 percent of design or phase-to-phase output short circuit occurs.
- c. The variable speed drive will restart automatically when input line returns to normal in the event of intermittent power outage or phase loss or overvoltage shutdown.
- d. Input power protection shuts down the unit if the following faults occur; low input line voltage or loss of an input phase.
- e. Insensitive to incoming power phase.
- f. Fast acting current limiting input fuses, (Class J) rated with 200,000 interrupting amperes capability.
- g. Isolated 115 volt control circuit and dedicated control transformer.
- h. Line-to-line fault protection.
- i. Line-to-ground short circuiting and accidental motor grounding protection.
- j. Output thermal overload relay trip.

#### 2.3.3.7 Adjustments

The variable speed drive has the following adjustments available via potentiometers located on the faceplate of a single, regulator printed circuit board.

- a. Minimum speed: 0-70 percent
- b. Maximum speed: 100 percent

### 2.4 EQUIPMENT APPURTENANCES

#### 2.4.1 Attachments

All necessary bolts, nuts, washers, bolt sleeves, and other types of attachments for the installation of the equipment shall be furnished with the equipment. Bolts shall conform to the requirements of ASTM A 307 and nuts shall be hexagonal of the same quality as the bolts used. Threads shall be clean-cut and shall conform to ASME B1.1. Bolts, nuts, and washers specified to be galvanized or not otherwise indicated or specified, shall be zinc coated after being threaded, as appropriate. Bolts, nuts, and washers specified or indicated to be stainless steel shall be Type 316.

#### 2.4.2 Equipment Guards

Equipment driven by open shafts, belts, chains, or gears shall be provided

with all-metal guards enclosing the drive mechanism. Guard shall be constructed of galvanized sheet steel or galvanized woven wire or expanded metal set in a frame of galvanized steel members. Guards shall be secured in position by steel braces or straps which will permit easy removal for servicing the equipment. The guards shall conform in all respects to all applicable safety codes and regulations.

#### 2.4.3 Tools

A complete set of all special tools which may be necessary for the adjustment, operation, maintenance, and disassembly of all equipment shall be furnished. Special tools are considered to be those tools which because of their limited use are not normally available, but which are necessary for the particular equipment. Special tools shall be high-grade, smooth, forged, alloy, tool steel. One pressure grease gun for each type of grease required for motors shall also be furnished. All tools shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such tools until completion of the work, at which time they shall be delivered to the Contracting Officer.

#### 2.4.4 Shop Painting

All motors, pump casings, and similar parts of equipment customarily finished in the shop shall be thoroughly cleaned, primed, and given two finish coats of paint at the factory in accordance with the recommendations of the manufacturer. Ferrous surfaces not to be painted shall be given a shop coat of grease or other suitable rust-resistant coating.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Each pump shall be installed in accordance with the written instructions of the manufacturer.

##### 3.1.1 Concrete Foundations

Concrete for equipment foundations shall be as specified in Section 03300 CAST IN PLACE STRUCTURAL CONCRETE. Concrete foundations shall be integral with and of the same class as that of the building floor unless otherwise indicated. Concrete having a compressive strength of at least 2,500 psi shall be used in foundations that are entirely separated from the surrounding floor. A premolded filler strip shall be installed between the foundation and floor slab as shown. Foundation bolts, as required, shall be furnished for proper positioning during the placement of the concrete.

#### 3.2 TESTS

After installation of the pumping units and appurtenances is complete, operating tests shall be carried out to assure that the pumping installation operates properly. Each pumping unit shall be given a running field test in the presence of the Contracting Officer for a minimum of 2 hours. Each pumping unit shall be operated at its rated capacity or such other point on its head-capacity curve selected by the Contracting Officer.

The Contractor shall provide an accurate and acceptable method of measuring the discharge flow. Tests shall assure that the units and appurtenances have been installed correctly, that there is no objectionable heating, vibration, or noise from any parts, and that all manual and automatic controls function properly. If any deficiencies are revealed

during any tests, such deficiencies shall be corrected and the tests shall be reconducted.

### 3.3 FIELD PAINTING

Stainless steel, galvanized steel, and nonferrous surfaces shall not be painted.

#### 3.3.1 Touch-Up Painting

Factory painted items requiring touching up in the field shall be thoroughly cleaned of all foreign material and shall be primed and topcoated with the manufacturer's standard factory finish.

#### 3.3.2 Exposed Ferrous Surfaces

Exposed ferrous surfaces shall be painted with two coats of enamel paint conforming to SSPC Paint 21. Factory primed surfaces shall be solvent-cleaned before painting. Surfaces that have not been factory primed shall be prepared and primed with one coat of SSPC Paint 25 or in accordance with the enamel paint manufacturer's recommendations.

### 3.4 MANUFACTURER'S REPRESENTATIVE

The Contractor shall obtain the services of a manufacturer's representative experienced in the installation, adjustment, and operation of the equipment specified. The representative shall supervise the installation, adjustment, and testing of the equipment. Up to 2 days service shall be provided at no expense to the Government.

### 3.5 DEMONSTRATION

Upon completion of the work and at a time designated by the Contracting Officer, the services of one or more competent engineers shall be provided by the Contractor for a training period of not less than 4 hours to instruct a representative of the Government in the operation and maintenance of equipment furnished under this section of the specifications. These field instructions shall cover all the items contained in the bound instructions.

-- End of Section --

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SECTION 11242A

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12/01

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## SECTION 11242A

## CHEMICAL FEED SYSTEMS

12/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI A13.1 (1996) Scheme for the Identification of Piping Systems
- ANSI Z400.1 (1998) Hazardous Industrial Chemicals - Material Safety Color Data Sheets - Preparation

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM D 1785 (1999) Poly(Vinyl Chloride)(PVC) Plastic Pipe, Schedules 40, 80, and 120
- ASTM D 1998 (1997) Polyethylene Upright Storage Tanks
- ASTM D 3299 (2000) Filament-Wound Glass-Fiber-Reinforced Thermoset Resin Corrosion-Resistant Tanks
- ASTM D 5421 (1993) Contact Molded "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Flanges
- ASTM E 1067 (1989; R 1996) Acoustic Emission Examination of Fiberglass Reinforced Plastic Resin (FRP) Tanks/Vessels
- ASTM F 441/F 441M (1999) Chlorinated Poly(Vinyl Chloride).(CPVC) Plastic Pipe, Schedules 40 and 80

## AMERICAN WATER WORKS ASSOCIATION(AWWA)

- AWWA B201 (1998) Soda Ash
- AWWA B300 (1999) Hypochlorites
- AWWA B302 (2000) Ammonium Sulfate
- AWWA B303 (2000) Sodium Chlorite
- AWWA B402 (2000) Ferrous Sulfate

AWWA B403	(1998) Aluminum Sulfate - Liquid, Ground, or Lump
AWWA B404	(1998) Liquid Sodium Silicate
AWWA B405	(2000) Sodium Aluminate
AWWA B406	(1998) Ferric Sulfate
AWWA B407	(1998) Liquid Ferric Chloride
AWWA B408	(1998) Liquid Polyaluminum Chloride
AWWA B451	(1998) Poly(Diallyldimethylammonium Chloride)
AWWA B452	(1998) EPI-DMA Polyamines
AWWA B453	(1996; Addendum 1997) Polyacrylamide
AWWA B501	(1998) Sodium Hydroxide (Caustic Soda)
AWWA B502	(1994; Addendum 1997) Sodium Polyphosphate, Glassy (Sodium Hexametaphosphate)
AWWA B503	(1994; Addendum 1997) Sodium Tripolyphosphate
AWWA B504	(1994; Addendum 1997) Monosodium Phosphate, Anhydrous
AWWA B505	(1995; Addendum 1997) Disodium Phosphate, Anhydrous
AWWA B511	(2000) Potassium Hydroxide
AWWA B550	(2000) Calcium Chloride
AWWA B600	(1996) Powdered Activated Carbon
AWWA B601	(2000) Sodium Metabisulfite
AWWA B602	(1991; Addendum 1997) Copper Sulfate
AWWA B603	(1998) Potassium Permanganate
AWWA B701	(1999) Sodium Fluoride
AWWA B702	(1994; Addendum 1997) Sodium Fluorosilicate
AWWA B703	(1995; Addendum 1997) Fluorosilicic Acid
ASME INTERNATIONAL (ASME)	
ASME B16.1	(1998) Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.11	(1996) Forged Fittings, Socket-Welding and

## Threaded

ASME B16.5	(1996; B16.5a) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24
HYDRAULIC INSTITUTE (HI)	
HI 7.1-7.5	(1994) Controlled Volume Pumps
HI 9.1-9.5	(1994) Pumps - General Guidelines
NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)	
NEMA 250	(1997) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ICS 1	(1993) Industrial Control and Systems
NEMA ICS 2	(1993) Industrial Controls and Systems Controllers, Contactors, and Overload Relays Rated Not More Than 2,000 Volts AC or 750 Volts DC
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 37	(1998) Installation and Use of Stationary Combustion Engines and Gas Turbines
NFPA 70	(1999) National Electrical Code
NSF INTERNATIONAL (NSF)	
NSF 60	2000 Drinking Water Treatment Chemicals - Health Effects
PLUMBING-HEATING-COOLING CONTRACTORS NATIONAL ASSOCIATION (NAPHCC)	
NAPHCC Plumbing Code	(1996) National Standard Plumbing Code
UNDERWRITERS LABORATORIES (UL)	
UL 50	(1995; Rev thru Nov 1999) Enclosures for Electrical Equipment

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

## Installation; G-DO

Detail drawings containing complete piping, wiring, schematic, flow diagrams, and any other details required to demonstrate that the system has been coordinated and will properly function as a

unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for installation, maintenance and operation.

#### SD-03 Product Data

##### Chemical Feed Systems; G-DO

Manufacturer's descriptive and technical literature, catalog cuts, performance charts, and pump curves.

List of materials, list of equipment, including a complete list of parts and supplies with current unit prices and source of supply. List of special tools for each type of equipment furnished including special tools necessary for adjustment, operation, maintenance, and disassembly.

##### Material Safety Data Sheet; G-AO.

Material safety data sheets in conformance with ANSI Z400.1 each chemical.

#### SD-06 Test Reports

##### Field Testing; G-AO

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

#### SD-10 Operation and Maintenance Data

##### Chemical Feed Systems; G-AO

Six complete copies of operating instructions outlining the step-by-step procedures required for system startup, operation and shutdown. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. The instructions shall include as-built drawings of the piping layout, equipment layout, and simplified wiring and control diagrams of the system as installed. Flow diagrams shall be included in the instructions.

Six complete copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and trouble-shooting guides.

### 1.3 SYSTEM DESCRIPTION

Chemical feed systems shall consist of a chemical supply storage tank or carboy from which the chemical solution shall be pumped through piping or tubing, as appropriate, to the point of application. The chemical feed/pumping systems to be addressed under this specification include a formalin feed system and a hydrogen peroxide feed system. Additional chemicals as defined will be procured under this specification, but will

not require a pumping system. Each of the two chemical feed systems shall include controlled volume pumps, tanks, mixers, gauges, back pressure regulators, strainers, pressure relief valves, sight glasses and flow metering devices, check valves, and hand valves, as necessary for the application method.

#### 1.3.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

#### 1.3.2 Design Requirements

Design and fabrication of the pumps shall be in accordance with HI 7.1-7.5 and HI 9.1-9.5 except as modified herein. Pump stands and platforms shall be adequate to support the pumping system.

#### 1.3.3 Performance Requirements

Capacity and design of the chemical feed systems and accessories shall be suitable for 24-hour full load service in ambient, non freezing conditions.

#### 1.3.4 Nameplates

Each major item of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

### 1.4 FIELD MEASUREMENTS

The Contractor shall become familiar with details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

### 1.5 DELIVERY AND STORAGE

Material and equipment delivered and placed in storage shall be stored with protection from the weather, excessive humidity and excessive temperature variation, dirt, dust, or other contaminants.

### 1.6 AUXILIARY EQUIPMENT AND SPARE PARTS

Concurrent with delivery and installation of the specified equipment, auxiliary equipment and spare parts shall be furnished as follows:

- a. Spare parts for each different item of material and equipment specified including all of the parts recommended by the manufacturer to be replaced after 1 year of service.
- b. For each machine: one extra of each part used that is made from glass, hard rubber, or clear plastic; one extra set of solution-hose connections; one extra set of diaphragms, two filler plug seal washers; two ball checks; two seats; two complete sets of all gaskets; one spare diaphragm for each back pressure regulator; one hydraulic plunger assembly for each different size

metering pump; one of each type of material back pressure regulator, with three spare springs and fluorocarbon resin diaphragms for each; one spare diaphragm and air valve for pulsation dampener.

- d. One set of special tools for each type of equipment including calibration devices, and instruments required for adjustment, calibration, disassembly, operation, and maintenance of the equipment.

## PART 2 PRODUCTS

### 2.1 CHEMICALS

A 90 day supply at the maximum pumping rate for each feeder or pair of duplexed feeders, or the amount specified, shall be provided. Chemicals shall conform to the following:

#### 2.1.1 Hatchery Support Chemicals

Tetracycline. 3 Gallon carboy, initial supply volume.

Iodine. 1 gallon, initial supply volume.

Both Tetracycline and Iodine are provided as chemical purchase only - no pumping system required for their use.

#### 2.1.2 Biocides

Formalin. 55 gallon drum, initial supply volume.

Cutrine. One gallon initial supply volume.

Formalin usage requires a pumped system as defined herein. Cutrine shall be provided as chemical purchase only - no pumped system required.

#### 2.1.3 Disinfecting Agents

Quaternary Ammonia. 1 gallon, initial supply volume.

AWWA B300 sodium hypochlorite. 55 gallon drum, initial supply volume.

Hydrogen Peroxide, 50% solution: 55 gallon drum, initial supply volume.

Quaternary Ammonia and sodium hypochlorite are provided as chemical purchase only - no pumping system required for their use. Hydrogen Peroxide requires a pumped system as defined herein.

### 2.2 CONTROLLED VOLUME PUMPS

Pumps shall be controlled volume pumps as defined by HI 7.1-7.5. Each pump shall be capable of delivering chemical solution at any rate from the minimum flow rate to the maximum flow rate and shall be capable of continuous operation at rated capacity. Accuracy shall be plus or minus 2 percent over a 100 to 1 range from the required maximum capacity to the minimum pumping rate. Net positive suction head required shall not exceed 90 percent of the net positive suction head available, as installed. Construction shall be as simple as practicable to provide equipment isolation, bypass and reliable service and to be readily accessible for inspection, cleaning, adjustment, repairs, and replacements.

#### 2.2.1 Biocide Feed System

The following shall be provided for formalin solution delivery.

Concentration: 37 percent formaldehyde gas in 10 -15% methanol.

Number of pumps: 2 - one primary, one spare (not connected/plumbed).

Type of pump: Mechanically or hydraulically coupled diaphragm.

Configuration: Simplex.

Controls: Semiautomatic and Manual rate adjustment.

Feed/flow rate: Minimum 0 gph; maximum 4 gph.

Back pressure at point of injection: 5 psig. Back pressure regulating valve shall be installed on the pump discharge. Regulators shall be of polyvinyl chloride or chlorosulphonated polyethylene diaphragms.

Suction valve and discharge valve cartridges: Single or Double ball check.

Materials of construction allowed for wetted parts: polypropylene, teflon, fluorocarbon resin, PVC (Class 12454-B).

#### 2.2.2 Disinfecting Agent Feed Systems

The following shall be provided for the hydrogen peroxide solution delivery.

Concentration: 50 percent.

Number of pumps: 2 - one primary, one spare (not connected/plumbed).

Type of pump: Mechanically or hydraulically coupled diaphragm.

Configuration: Simplex.

Controls: Semiautomatic or manual rate adjustment.

Feed/flow rate: Minimum 0 gph; maximum 4 gph.

Back pressure at point of injection: 5 psig. Back pressure regulating valve shall be installed on the pump discharge. Regulators shall be of polyvinyl chloride or chlorosulphonated polyethylene diaphragms.

Suction valve and discharge valve cartridges: Single or double ball check.

Materials of construction allowed for wetted parts: PVC, hypalon, fluorocarbon resin, teflon, polypropylene.

### 2.3 CONTROLS

The chemical metering equipment shall be provided with the appurtenances and accessories, as required, for flow capacity adjustment. Manual range adjustment shall be provided on all systems.

#### 2.3.1 Semiautomatic Control

Semiautomatic control shall have the capability to automatically start and stop the chemical metering equipments. The pump start and stop shall respond to flow switch or timer status. Flow switch for semiautomatic operation shall be installed in the pipe line upstream of chemical injectors.

### 2.3.2 Manual Control

Nonautomatic control shall have the capability for starting or stopping the chemical metering equipment and adjustment of the solution feed rate by the operator. Semicontinuous operation shall be provided for where intermittent dosages may be desired (for example control of biocide addition where periodic (shock) treatment is sufficient or preferred).

## 2.4 DRIVES FOR CONTROLLED VOLUME PUMPS

The metering pumps shall be supplied with and driven by alternating current electric motor drives.

### 2.4.1 Electric Motor Drive

Electric motor shall be of sufficient capacity to operate the chemical metering equipment under all operating conditions without exceeding their rated nameplate current or power, or their specified temperature limits. The motors shall have starting characteristics and ruggedness necessary under the actual conditions of operations or clean-up procedures used in the areas where they will be located. Alternating current motors with power rating of 1/3 hp or less shall be 110 to 120 volts, single-phase, 60-Hz service.

## 2.5 CALIBRATION STANDPIPES

Chemical chemical metering equipment shall be provided with a calibration standpipe for measuring pump output. The standpipe shall allow convenient observation of the change of fluid level for at least 1/2 minute at full stroke and maximum speed settings, and shall be Schedule 80, clear PVC pipe conforming to ASTM D 1785 with Schedule 80 fittings equipped with a flanged connection to the pump manifold and an end cap fitted with a PVC vacuum breaker and ball valve for air venting. The standpipe shall have a clear, observable length of at least 12 inches and shall be permanently calibrated in gallons and fractions thereof, to allow reading of the fluid contents with an accuracy of 1 percent.

## 2.6 VALVES

### 2.6.1 Metering Pump Valves

The metering pump shall be equipped with adjustable internal vacuum and pressure relief valve, hydraulic oil refill valve, and automatic air bleed valve. The relief valve shall be adjustable over the full pressure range of the pump and shall be preset at the factory.

### 2.6.2 Suction and Discharge Valves

Suction and discharge valve cartridges shall be fitted with ball checks that open to full pipe diameter.

### 2.6.3 Back Pressure Valve

Back pressure regulating valve shall be installed on the pump discharge and factory adjusted to crack open at the required pressure. Diaphragms shall be spring opposed with loading pressures adjustable by means of a screw in the top works.

#### 2.6.4 Pulsation Dampeners

Pulsation dampeners shall be suitably sized for the displacement of each pump. Pulsation dampeners shall have a diaphragm separating the upper chamber from the lower chamber. The upper chamber shall be charged with compressed air to 50 percent of the expected line pressure. The diaphragm shall be of molded construction and shall prevent the air charge from being dissolved in the process fluid. The lower chamber shall be plastic or lined with inert plastic material to prevent corrosion by the process fluid. The upper chamber shall be equipped with a tire valve type charging valve and air pressure gauge. An air line and air hose with pressure regulator and hand-operated, lever-type valve suitable for charging the pulsation dampers shall also be provided.

#### 2.7 SOLUTION TANKS

Tanks shall be fully resistant to the effects of the full-strength and fully diluted solution concentrations. Tanks shall be pressure rated for 1.5 times the weight of solution at full capacity. Each tank shall have the capacity listed and shall be equipped with a fill nozzle, vent, discharge, level instrument, drain, and two spare connections. Tanks shall be reinforced to withstand all forces when full of solution. Tanks shall be completely shop fabricated with no field assembly permitted. Drain connections shall provide complete drainage of the tank. All gaskets shall be compatible with the stored solution; nuts and bolts shall be Type 316 stainless steel; and steel supports shall be either stainless or epoxy coated. A permanent plastic sign indicating the tank contents shall be attached to the front of each tank. Tanks smaller than 36 inches in diameter shall be fitted with removable lids. Polyethylene tanks shall be manufactured in accordance with ASTM D 1998. Fiberglass tanks shall be manufactured in accordance with ASTM D 3299 with flanged openings in accordance with ASTM D 5421. Tanks designated to be double walled or provided with secondary containment shall be provided with containment separate from the containment provided for other tanks to prevent reaction within the contained area. Dissolving baskets and tank mixers shall be provided as indicated and shall be sized to provide initial mixing and to maintain suspensions. Floating seals shall be provided as indicated.

##### 2.7.1 Biocide Tank

Tank shall be formalin solution resistant.

Number of tanks: 1.

Minimum tank capacity: as previously indicated

##### 2.7.2 Disinfecting Agent Tank

Tank shall be hypochlorite solution and 50% hydrogen peroxide resistant.

Number of tanks: 2, total. One for hypochlorite solution and one for 50% hydrogen peroxide.

Minimum tank capacity: as previously indicated.

#### 2.8 PRESSURE GAUGES

Gauges shall be diaphragm type with Bourdon tube and diaphragm compartments filled completely with oil, and shall be made of materials suitable for the

application. Diaphragm seals shall be installed at each gauge connection to isolate gauges from corrosion, sludge or other hazards of the process fluid. Seal material shall be compatible with the oil in the gauge and the process fluid.

## 2.9 INJECTORS

Injectors for chemical solution shall be introduced into the pipeline mains or head tanks by means of a hard rubber or plastic injection nozzle, or by means of a suitable diffuser tube inserted through a corporation cock. The device for introducing the solution into a pressure main shall be constructed in such a way that accidental breakage of discharge hose or tubing will not cause water to escape from the pipeline, and will allow disassembling of the unit without leakage.

## 2.10 PIPING

### 2.10.1 Backflow Preventer

Backflow prevention devices or air gaps shall be provided on tank fill lines in accordance with NAPHCC Plumbing Code.

### 2.10.2 Chemical Solution Piping

Provisions shall be incorporated to allow solution piping to be conveniently and safely bled of trapped air and minimize infiltration of air bubbles. Chemical solution piping shall be in as defined herein.

#### 2.10.2.1 Smaller than 1-1/2 inch Diameter

Chemical solution piping smaller than 1-1/2 inch diameter for formalin solution shall be PVC (Class 12454-B), polypropylene, teflon, or PVDF. Fittings for plastic pipe shall be of the same material as the plastic piping, with flanged or threaded joints.

Chemical solution piping smaller than 1-1/2 inch diameter for 50% hydrogen peroxide solution shall be PVC, hypalon, fluorocarbon resin, teflon, PVDF, or polypropylene. Fittings for plastic pipe shall be of the same material as the plastic piping, with flanged or threaded joints.

### 2.10.3 Plumbing

Water piping, drain, waste and vent piping shall be in accordance with Section 15400A PLUMBING, GENERAL PURPOSE.

## 2.11 ELECTRICAL WORK

Electric motor-driven equipment shall be provided complete with motor, motor starter, and controls. Electrical equipment and wiring shall be in accordance with Section 16415A ELECTRICAL WORK, INTERIOR. Hazard classifications indicated on the drawings shall be implemented in accordance with NFPA 70.

### 2.11.1 Motor Starters

Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary for the motor control specified.

### 2.11.2 Control and Protective Devices

Manual or automatic control and protective or signal devices required for the operation and any control wiring required for controls and devices shall be provided. Motor controls shall conform to NEMA ICS 1 or NEMA ICS 2. Equipment shall be prewired to the maximum practicable extent. Control cabinets shall conform to the requirements of UL 50, NEMA 1.

#### 2.12 EQUIPMENT APPURTENANCES

Bolts, nuts, anchors, washers and all other types of supports necessary for the installation of the equipment shall be galvanized steel, cadmium plated or Type 316 stainless steel.

#### 2.13 FACTORY PAINTING

Factory painting shall conform to manufacturer's standard factory finish, provided it does not discolor in the presence of high water vapor atmosphere, and oxidizing conditions. Coating shall be not less than 1.75 mils thick.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

##### 3.1.1 Chemical Feeding Equipment

Controlled volume pumps, equipment, and appurtenances shall be installed to provide a complete and integrated system in accordance with the instruction of the manufacturer and under the direct supervision of the manufacturer's representative.

##### 3.1.2 Pipe, Tubing, Hangers and Supports

The installation of pipes and tubes shall be in accordance with Section 15400A PLUMBING, GENERAL PURPOSE.

#### 3.2 FIELD PAINTING

Factory painted items requiring touching up in the field shall be thoroughly cleaned of all foreign material and shall be primed and top-coated with the manufacturer's standard factory finish provided it does not discolor in the presence of high water vapor atmosphere, and oxidizing conditions. Equipment which did not receive a factory finish shall be painted as specified in Section 09900 PAINTING, GENERAL. Coating shall be not less than 1.75 mils thick. Piping identification shall be as specified in Section 09900 PAINTING, GENERAL. Pipe carrying materials not listed in Section 09900 PAINTING, GENERAL shall be marked in accordance with ANSI A13.1.

#### 3.3 FIELD TESTING

After installation of each controlled volume pump, operating tests shall be carried out to assure that the chemical metering installation operates properly. If any deficiencies are revealed during any tests, such deficiencies shall be corrected and the tests shall be reconducted. Reports of all tests shall be submitted prior to final acceptance of the installation.

##### 3.3.1 Tanks

Tanks shall be cleaned of loose debris and dried prior to testing. Tanks shall be field tested for leaks or damage in shipment. The tanks shall be hydrostatically tested to 1.5 times the system operating pressure to detect large leaks and then with the specified chemical to detect small leaks. Tanks shall be tested with each solution for a period of 24 hours at which time no visible leakage shall be evident. All pipes, hoses, pumps, water, power and other equipment required to convey the test liquids and to carry out the tests shall be supplied by the Contractor. Damage or leaks in tanks shall be repaired or tanks shall be replaced.

### 3.3.2 Controlled Volume Pumps

Pumps shall be tested to demonstrate that the pumps are capable of operating without vibration or leakage. Testing shall be performed at the maximum design flow rate and at half the design flow rate. Testing shall be demonstrated while controlled and operated in all feasible modes with the pumps operated singly and in unison. The response of each pump shall be plotted on curves for the various operating pressures encountered and the results shall be compared to the curves shown on the manufacturer's published pump data. If control characteristic curves are not available at the time of testing, the pump manufacturer's service engineer shall generate such curves for each pump. Pump curves shall graphically depict the pump displacement at 25, 50, 75, and 100 percent of motor speed for SCR equipped pumps, and at 25, 50, 75, and 100 percent of maximum stroke position for all pumps. Curves shall be generated only for the specified back pressure.

### 3.3.3 Time, Volume and Pumping Pressure

Pumps shall be tested by filling the standpipe with chemical and measuring the outage, with all other equipment valved off. The time, volume and pumping pressures shall be recorded.

### 3.3.4 Test Pressure

Tests shall be carried out at 10 psig. Back pressure valves shall be manually controlled for this testing, and shall be reset as necessary after testing. The time to deliver a given quantity of chemical at a given stroke and speed setting shall be the same at all pressures.

### 3.3.5 Flow

Pumps shall be tested to demonstrate zero gallons per minute flow at a zero stroke or speed setting. Failure to meet this test shall be cause for rejection.

### 3.3.6 Synchronization

The pumps shall be operated for a period of 4 hours to demonstrate that the double diaphragm systems do not lose their synchronization. Loss of synchronization shall also be cause for rejection and the pump shall be repaired or replaced as necessary. Repaired or replaced equipment shall be fully retested.

### 3.3.7 Chemical Waste

Chemicals wasted during testing procedures shall be neutralized to achieve a pH value between 6.5 and 9.5. All chemicals wasted during testing procedures shall be routed to the sanitary sewer at a rate that the process

can assimilate without upset, not to exceed 1 gpm.

#### 3.4 FRAMED INSTRUCTIONS

Framed instructions containing wiring and control diagrams shall be posted where directed. Condensed operating instructions shall be posted as specified above.

#### 3.5 FIELD TRAINING

The Contractor shall conduct a field training course for designated operating, maintenance and supervisory staff members. Training shall be provided for a total period of 4 hours of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the items contained in the operating and maintenance instructions.

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## SECTION 11301A

## PACKED COLUMNS

04/99

## PART 1 GENERAL

## 1.1 UNIT PRICES

Measurement and payment and unit prices for quantities of water treated will be determined in accordance with the Bid Schedule.

## 1.2 SYSTEM DESCRIPTION

The packed column equipment shall be as specified in PART 2 of this section.

## 1.2.1 Design Requirements

The following requirements shall be met:

- a. Water flow rate, per column
 

Maximum	420 gpm
Minimum	0 gpm
  
- b. Water temperature
 

Maximum	72 degrees F
Minimum	38 degrees F
  
- c. Design Life
 

Minimum	20 years
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- d. Packed column dimensions
  - Maximum vertical projection:
    - 5'9" above tank sidewall for packed column height;
    - 7'4" to top of piping over packed column.
  - Maximum outside diameter:
    - As required to fit within tank openings and allow positioning
  - Minimum dimensions:
    - Minimum nominal inside dimensions shall be as indicated in the drawings and herein unless otherwise approved. If outside diameter is significantly less than indicated, Contractor shall adjust tank opening to limit maximum possible gap between packed column and edge of opening to 6 inches.
  
- e. Ambient air temperature (building air usage)
 

Maximum	75 degrees F
Minimum	50 degrees F

## 1.2.2 System Performance Requirements

## 1.2.2.1 Operating Schedule

Capacity and design of the packed column and accessories shall allow the

system to operate continuously for 24 hours per day, 7 days per week.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

##### Materials and Equipment; G-DO

Detail drawings consisting of a complete list of material, including manufacturer's descriptive and technical literature, catalog cuts, drawings, and installation instructions. Packing, packed column shell, distribution plates, water inlet and outlet, air inlet and outlet, access openings, adjustable supports, and construction in general. Detail drawings shall demonstrate that the system has been coordinated and will function as a unit. Drawings shall show proposed layout and mounting and relationship to other parts of the work.

#### SD-03 Product Data

##### Packed Column System; G-DO

Manufacturing description, performance charts, technical literature, catalog cuts for packing, packed column, materials of construction for any proposed packed column construction other than that indicated on the drawings.

##### Equipment; G-AO

Parts list including recommended spare parts and maintenance supplies with current unit prices and source of supply for each item of operable equipment. List of all special tools, instruments, accessories, and special lifting and handling devices required for periodic maintenance, repair, adjustment, and calibration.

#### SD-06 Test Reports

##### Tests; G-AO

Performance reports in booklet form, upon completion of testing of the installed system. Test reports shall include all field tests performed to adjust each component.

#### SD-10 Operation and Maintenance Data

##### Packed Column System; G-DO

##### Maintenance; G-DO

The following information can either be included in the manual or manufacturer literature that contains the information and is furnished with the O&M Manuals. Each manual shall have an index listing the contents. Manuals shall be bound in sturdy

three-ring, loose-leaf binders.

Six complete copies of operating instructions for approved packed columns designed and fabricated in accordance with manufacturer's standard design. An introduction and overall equipment description, purpose, functions, and simplified theory of operation shall be included in the beginning of the instructions. The instructions shall include the manufacturer's name, model number, parts list and brief description of each piece of equipment and its basic theory and operating features. The instructions shall include piping and component layouts and wiring and control diagrams for the systems as installed.

For approved packed columns fabricated in accordance with manufacturer's standard design, provide six complete copies of maintenance instructions listing routine maintenance procedures, calibration procedures, possible breakdowns and repairs and trouble shooting guides. Procedures for cleaning and removal of scale shall be included.

For packed columns constructed in accordance with the indicated details, submit six complete copies of shop drawings showing packed column materials, details of construction, and installation.

#### 1.4 QUALIFICATIONS

##### 1.4.1 Single Source Supplier

The Contractor shall assign to a single supplier full responsibility for the furnishing of the packed column system. The designated single supplier, however, need not manufacture the system but shall coordinate the design, assembly, installation, and testing of the entire system as specified herein.

##### 1.4.2 Welding

Welding shall be performed by certified welders.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

Parts shall be preassembled to the extent practical, compatible with transportation limitations and equipment protection considerations. Field assembly, if any, shall require merely bolting together of match-marked components. Equipment shall be crated and protected against damage during shipping and delivery. Flange faces shall be protected from damage. Openings shall be covered to prevent entrance of dirt, water and debris. Parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation. Finished iron or steel surfaces shall be properly protected to prevent rust and corrosion. All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust, and other contaminants.

#### 1.6 GENERAL REQUIREMENTS

##### 1.6.1 Standard Products

For alternative packed column designs, Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate equipment that has been in satisfactory operation for at least 2 years prior to bid opening.

#### 1.6.2 Nameplates

For alternative packed column designs, major equipment items shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

#### 1.6.3 Verification of Dimensions

After becoming familiar with all details of the work, the Contractor shall verify all dimensions, and shall advise the Contracting Officer of any discrepancy before performing the work.

### PART 2 PRODUCTS

#### 2.1 PACKED COLUMN COMPONENTS

The degassing system shall consist of seven separate packed column air strippers (three on each raw water tank, and one on the heated water storage tank) to transfer dissolved gases from the water phase to the air phase, as well as to oxygenate the influent water. For alternative packed column designs, the Contractor shall use manufacturer's standard size units whenever possible.

##### 2.1.1 Assembly

The system shall be factory pre-assembled into reasonably sized modules for easy field assembly.

##### 2.1.2 Pipe Connections

Influent pipe connections shall be full line diameter of the connecting pipe. Effluent discharge openings into the tank shall be such that essentially no head will be developed at the discharge.

#### 2.2 PACKED COLUMNS

The Contractor shall provide packed columns with the following features: A shell filled with open plastic, or ceramic packing material that has a large surface area to volume ratio. The raw water is pumped above the packing and is distributed onto the packing with a distribution plate or other device to distribute the water uniformly over the packing. A forced air blower forces air through an opening at the bottom of the column for countercurrent flow. The air stream then carries the gases out of the top of the column and through a duct which vents to the building exterior. The discharge openings at the bottom of the packed column are submerged in the degassed water, even at extreme low water levels, preventing offgas air from escaping into the mechanical room. All fasteners are stainless steel. The packed column shall be provided with adjustable supports.

##### 2.2.1 Packed Column Performance Requirements

For alternative packed column designs, the following performance conditions and requirements shall apply:

- a1. Air to water ratio, tanks 1 and 2  
Maximum at maximum flow 6.5:1 volume/volume
- a2. Air to water ratio, tank 4  
Maximum at maximum flow 2.7:1 volume/volume
- b. Packing surface area  
Minimum 45 sf/cu. ft.
- c. Percentage of flooding at maximum water flow and maximum  
air to water ratio  
Maximum 70 percent
- d. Packing Factor  
Minimum 12 per ft

#### 2.2.2 Packing

The column shall be filled with high efficiency open packing, either structured "arranged" or random "dumped" media, as indicated or approved. Media shall be polypropylene, PVC, ceramic or other material that is durable under the service conditions as indicated or approved. Packed section of the column shall be 3.5 feet (nominal) in diameter and the height of the packing shall be 4 feet. (nominal)

#### 2.2.3 Water Distribution System

Water distribution system shall be PVC or steel distributor that distributes the water over the full area of the packing. The distribution system shall be designed for easy removal and replacement.

#### 2.2.4 Packing Support Plate

Packing support plate shall be PVC, HDPE, steel plate or fiberglass reinforced plastic. The plate shall be of suitable thickness to prevent deformation when the packing becomes plugged and the entire shell above the packing support fills with water.

#### 2.2.5 Packed Column Shell Materials

Packed column shells shall be constructed of fiberglass reinforced plastic (FRP), galvanized steel, or suitable seamless one piece molded modular sections of a plastic material. Fabrication shall conform to the indicated details, or, for alternative designs, in accordance with the manufacturer's recommended fabrication procedures. The design, fabrication, and erection shall be as specified herein.

#### 2.2.6 Access

The top of each packed column shall be bolted to provide access to packed column internals from above.

#### 2.2.7 Manways and Pipe Connections

Number, type, location, and size of manways and pipe connections shall be as shown on the drawings and as specified herein. Flanged access ports, 24 inch in diameter, shall be provided, and shall be water and vapor tight, and able to withstand all loads and internal pressures during construction, operation, and cleaning.

## 2.3 ACCESSORIES

### 2.3.1 Fans

Fans, blowers and or vacuum pumps shall be in accordance with Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION and EXHAUST SYSTEM.

### 2.3.2 Exhaust Stack

Exhaust stack for alternative desings shall be sized so gas velocity shall not exceed 25 feet/second and shall not be less than 10 feet/second.

### 2.3.3 Packed Column Offgas Control

Off gases from the packed column shall be conveyed to the exterior of the hatchery building.

### 2.3.4 Electrical Work

#### 2.3.4.1 Electrical Equipment and Wiring

Electrical motor-driven equipment specified herein shall be provided complete with motor control centers, panels, motor starters, etc. Electrical equipment and wiring, including power and control wires shall conform to the requirements of Section 16415 ELECTRICAL WORK, INTERIOR. Instrumentation and controls shall conform to the requirements of Section 11211A PUMPS: WATER, CENTRIFUGAL with the interlocks and control devices specified herein and as shown on the drawings.

### 2.3.5 Spare Parts

Spare parts shall be provided for each different item of material and equipment specified, including all parts recommended by the manufacturer to be replaced after 1 year of service.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Equipment shall be installed as shown and in accordance with the written instructions of the manufacturer.

### 3.2 TESTS

#### 3.2.1 Visual Leakage Tests

Each unit shall be visually inspected for leaks during operation. Leaks shall be repaired and the column retested.

#### 3.2.2 Performance Testing

Each unit shall be operated at the maximum flow specified in the performance requirements for at least one hour.

### 3.3 PAINTING FOR CORROSION PREVENTION

#### 3.3.1 Packed Columns and Appurtanences

### 3.3.1.1 Exterior and Interior Surfaces

For packed columns constructed of materials other than those indicated, unless otherwise approved, all carbon steel items shall be shop-painted using epoxy paint similar to that specified for the water storage tanks.

### 3.3.2 Touch-up Painting

Factory painted items shall be touched up as needed. These items shall be cleaned of all foreign material and shall be primed and top coated with the manufacturer's standard factory finish.

### 3.3.3 Corrosion Resistant Metals

Painting of corrosion resistant materials such as copper, brass, bronze, copper-nickel, and stainless steel shall not be performed unless otherwise specified.

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## SECTION 11310A

PUMPS; SUBMERSIBLE CENTRIFUGAL (Pumps SP-1 and SP-2)  
11/90

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

## AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 9 (1990; R 2000) Load Ratings and Fatigue Life for Ball Bearings

ABMA 11 (1990; R 1999) Load Ratings and Fatigue Life for Roller Bearings

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 153/A 153M (1998) Zinc Coating (Hot-Dip) on Iron and Steel Hardware

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1 (1993) Industrial Controls and Systems

NEMA MG 1 (1993; Rev 1; Rev 2; Rev 3; Rev 4) Motors and Generators

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Equipment Installation; G-DO

Drawings containing complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

## SD-03 Product Data

## Submersible Centrifugal Pump System; G-DO

Pump characteristic curves showing capacity in gpm, net positive suction head (NPSH), head, efficiency, and pumping horsepower from 0 gpm to 110 percent (100 percent for positive displacement pumps) of design capacity. A complete list of equipment and material, including manufacturer's descriptive data and technical literature, performance charts and curves, catalog cuts, and installation instructions. Also includes diagrams, instructions, and other sheets proposed for posting.

## Spare Parts; G-AO

Spare parts data for each different item of material and equipment specified, after approval of the related submittals, and not later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

## SD-06 Test Reports

## Field Testing and Adjusting Equipment; G-AO

Performance test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

## SD-10 Operation and Maintenance Data

## Submersible Centrifugal Pump System; G-AO

Six copies of operation and maintenance manuals for the equipment furnished. One complete set prior to performance testing and the remainder upon acceptance. Operation manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operation manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout and simplified wiring and control diagrams of the system as installed. Manuals shall be approved prior to the field training course.

## 1.3 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be stored with protection from the weather, excessive humidity and excessive temperature variation; and dirt, dust, or other contaminants.

## 1.4 FIELD MEASUREMENTS

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of

any discrepancy before performing the work.

## PART 2 PRODUCTS

### 2.1 GENERAL MATERIAL AND EQUIPMENT REQUIREMENTS

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site. Pump casings shall be constructed of cast iron of uniform quality and free from blow holes, porosity, hard spots, shrinkage defects, cracks, and other injurious defects. Impellers shall be cast iron, brass, or ductile iron unless otherwise specified for rotors.

#### 2.1.1 Nameplates

Each major item of equipment shall have the manufacturer's name, address, type or style, model or serial number, flow and head data, and catalog number on a plate secured to the item of equipment.

#### 2.1.2 Equipment Guards

Belts, pulleys, chains, gears, projecting setscrews, keys, and other rotating parts so located that any person may come in close proximity thereto shall be enclosed or guarded.

#### 2.1.3 Special Tools

One set of special tools, calibration devices, and instruments required for operation, calibration, and maintenance of the equipment shall be provided.

#### 2.1.4 Electric Motors

Motors shall conform to NEMA MG 1.

#### 2.1.5 Motor Controls

Controls shall conform to NEMA ICS 1.

#### 2.1.6 Bolts, Nuts, Anchors, and Washers

Bolts, nuts, anchors, and washers shall be steel; galvanized in accordance with ASTM A 153/A 153M.

### 2.2 SUBMERSIBLE CENTRIFUGAL PUMPS

Submersible centrifugal pumps shall be centrifugal type pumps designed to pump solids up to 2 inches in diameter and shall be capable of withstanding submergence as required for the particular installation.

#### 2.2.1 Pump Characteristics

Pump numbers SP-1 and SP-2 located in the main process area sump shall have the following operating characteristics:

- a. Pump Service: Submersible centrifugal, Variable Frequency Drive.

- b. Design Operating Point, SP-1: 250 gpm flow, 66 feet head, 70 percent efficiency.
- b. Design Operating Point, SP-2: 750 gpm flow, 66 feet head, 70 percent efficiency.
- e. Impeller Type: enclosed, large port.
- f. Operating Speed: Variable Frequency Drive.
- g. Depth of Submergence: 7 feet, maximum.
- h. Motor Type: VFD.
- i. Electrical Characteristics: 460 volts ac, 3 phase, 60 Hz.
- k. Pump Control: See Contract Drawings.

#### 2.2.2 Pump Casing

The casing shall be capable of withstanding operating pressures 50 percent greater than the maximum operating pressures. The volute shall have smooth passages which provide unobstructed flow through the pump.

#### 2.2.3 Mating Surfaces

Mating surfaces where watertight seal is required, including seal between discharge connection elbow and pump, shall be machined and fitted with nitrile rubber O-rings. Fitting shall be such that sealing is accomplished by metal-to-metal contact between mating surfaces, resulting in proper compression of the O-rings without the requirement of specific torque limits.

#### 2.2.4 Coatings

All exposed nuts and bolts shall be stainless steel.

#### 2.2.5 Impeller

The impeller shall be of the enclosed, large port type. The impeller shall be statically, dynamically, and hydraulically balanced within the operating range and to the first critical speed at 150 percent of the maximum operating speed. The impeller shall be securely keyed to the shaft with a locking arrangement whereby the impeller cannot be loosened by torque from either forward or reverse direction.

#### 2.2.6 Wearing Rings

Wearing rings, when required, shall be renewable type and shall be provided on the impeller and casing and shall have wearing surfaces normal to the axis of rotation. Material for wear rings shall be standard of pump manufacturer. Wearing rings shall be designed for ease of maintenance and shall be adequately secured to prevent rotation.

#### 2.2.7 Pump Shaft

The pump shaft shall be of high grade alloy steel and shall be of adequate size and strength to transmit the full driver horsepower with a liberal safety factor.

### 2.2.8 Seals

A tandem mechanical shaft seal system running in an oil bath shall be provided. Seals shall be as recommended by the manufacturer with each interface held in contact by its own spring system.

### 2.2.9 Bearings

Pump bearings shall be ball or roller type designed to handle all thrust loads in either direction. Pumps depending only on hydraulic balance end thrust will not be acceptable. Bearings shall have an ABEMA L-10 life of 50,000 hours minimum, as specified in ABMA 9 or ABMA 11.

### 2.2.10 Motor

The pump motor shall have Class F insulation, NEMA B design, in accordance with NEMA MG 1, and shall be watertight. The motor shall be either oil filled, air filled with a water jacket, or air filled with cooling fins which encircles the stator housing.

### 2.2.11 Power Cable

The power cable shall comply with NFPA 70, Type SO, and shall be of standard construction for submersible pump applications. The power cable shall enter the pump through a heavy duty entry assembly provided with an internal grommet assembly to prevent leakage. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board which shall isolate the motor interior from foreign material gaining access through the pump top.

### 2.2.12 Installation Systems

#### 2.2.12.1 Rail Mounted Systems

Rail mounted installation systems shall consist of guide rails, a sliding bracket, and a discharge connection elbow. Guide rails shall be of the size and type standard with the manufacturer and shall not support any portion of the weight of the pump. The sliding guide bracket shall be an integral part of the pump unit. The discharge connection elbow shall be permanently installed in the wet well along with the discharge piping. The pump shall be automatically connected to the discharge connection elbow when lowered into place and shall be easily removed for inspection and service without entering the pump well.

#### 2.2.12.2 Bolt Down Systems

The pump mount system shall include a base designed to support the weight of the pump. The base shall be capable of withstanding all stresses imposed upon it by vibration, shock, and direct and eccentric loads.

#### 2.2.12.3 Lifting Chain

Lifting chain to raise and lower the pump through the limits indicated shall be provided. The chain shall be galvanized and shall be capable of supporting the pump.

## 2.3 ELECTRICAL WORK

Electrical motor driven equipment specified shall be provided complete with motors, motor starters, and controls. Electric equipment and wiring shall be in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Electrical characteristics shall be as specified or indicated. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary for the motor control specified. Manual or automatic control and protective or signal devices required for the operation specified, and any control wiring required for controls and devices but not shown, shall be provided.

#### 2.3.1 Electric Motors

Each submersible pump shall be driven by a continuous-duty electric submersible motor. Motors shall have normal-starting-torque and low-starting-current characteristics, and shall be of sufficient size so that the nameplate horsepower rating will not be exceeded throughout the entire published pump characteristic curve. Motor bearings shall provide smooth operations under the conditions encountered for the life of the motor. Adequate thrust bearing shall be provided in the motor to carry the weight of all rotating parts plus the hydraulic thrust and shall be capable of withstanding upthrust imposed during pump starting and under variable pumping head conditions specified. Submersible motors shall be rated 460 volts, 3 phase, 60 Hz and such rating shall be stamped on the nameplate.

#### 2.3.2 Control Equipment

Automatically controlled pumps shall have three-position "MANUAL-OFF-AUTOMATIC" selector switch in cover. Additional controls or protective devices shall be as indicated.

#### 2.3.3 Variable Speed Controls

The variable speed motor controller shall convert 460 volt plus 15 percent, minus 5 percent, three phase, 60 Hz (plus or minus 2 Hz) utility power to adjustable voltage/frequency, three phase, ac power for stepless motor control from 5 percent to 105 percent of base speed.

##### 2.3.3.1 Description

The variable speed drive shall produce an adjustable ac voltage/frequency output for complete motor speed control. The variable speed drive shall be automatically controlled by a grounded electronic control signal. The variable speed drive shall be self contained, totally enclosed in a NEMA MG 1 ventilated cabinet and capable of operation between 32 and 104 degrees F.

The variable speed drive maximum output current rating shall be equal to or exceed the motor nameplate full load. The manufacturer shall advise the maximum recommended motor sine wave current for each controller rating. Variable speed drive multiple motor operation at same frequency/speed shall be possible as long as the sum of connected motor full load sine wave currents are less than or equal to the variable speed drive maximum continuous current rating. Variable speed drive shall be 95 percent efficient at 100 percent rated output power, 60 Hz.

##### 2.3.3.2 Governing Requirements

Variable speed drives shall conform to the following requirements:

- a. Variable speed drive shall comply with 47 CFR 15 regulation of RF1/EM1 emission limits for Class A computing devices. The FCC

label of compliance shall be displayed on the variable speed drive.

- b. The variable speed drive and options shall comply with the applicable requirements and the standards of the American National Standards Institute (ANSI).
- c. Variable speed drive and option design and construction thereof shall comply with all applicable provisions of NFPA 70, Article 43D, Sections A-L.

#### 2.3.3.3 Quality Assurance

To ensure quality the variable speed drive shall be subject to the following tests:

- a. The integrated circuits shall undergo a 160-hour "burn-in" to test reliability. During the "burn-in" the temperature shall be cycled between 32 and 158 degrees F.
- b. The completed unit shall undergo a fully loaded 24-hour "burn-in."
- c. The unit shall be subject to a series of in-plant quality controlled inspections before approval for shipment from manufacturer's facilities.

#### 2.3.3.4 Service

The variable speed drive shall be supplied with the following:

- a. One-year parts and labor warranty.
- b. A troubleshooting guide to help the building operator determine what steps must be taken to correct any problem that may exist in the system.

#### 2.3.3.5 Basic Features

The variable speed drive shall have the following basic features:

- a. Hand/Off/Auto Operation.
- b. Manual/Auto speed reference switch.
- c. Minimum/maximum adjustable speeds.
- d. Speed potentiometer.
- e. Auto restart.
- f. Linear timed acceleration and deceleration for soft starting/stopping.
- g. 3-63 Hz controlled speed range. (Factory set at 15 Hz minimum).
- h. Terminal connections for time clock control, fire, smoke, freeze detectors, and EP relay pre-set speed override.
- i. Output frequency terminals for remote metering.

#### 2.3.3.6 Protective Circuits and Features

The variable speed drive controller shall include the following protective circuits/features:

- a. Current limits to 100 percent design by slowing down motor.
- b. Instantaneous Electronic Trip - automatically shutdown motor if current exceed 120 percent of design or phase-to-phase output short circuit occurs.
- c. The variable speed drive will restart automatically when input line returns to normal in the event of intermittent power outage or phase loss or overvoltage shutdown.
- d. Input power protection shuts down the unit if the following faults occur; low input line voltage or loss of an input phase.
- e. Insensitive to incoming power phase.
- f. Fast acting current limiting input fuses, (Class J) rated with 200,000 interrupting amperes capability.
- g. Isolated 115 volt control circuit and dedicated control transformer.
- h. Line-to-line fault protection.
- i. Line-to-ground short circuiting and accidental motor grounding protection.
- j. Output thermal overload relay trip.

#### 2.3.3.7 Adjustments

The variable speed drive has the following adjustments available via potentiometers located on the faceplate of a single, regulator printed circuit board.

- a. Minimum speed: 0-70 percent
- b. Maximum speed: 100 percent

### PART 3 EXECUTION

#### 3.1 EQUIPMENT INSTALLATION

##### 3.1.1 Pump Installation

Pumping equipment and appurtenances shall be installed in the position indicated and in accordance with the manufacturer's written instructions. All appurtenances required for a complete and operating pumping system shall be provided, including such items as piping, conduit, valves, wall sleeves, wall pipes, concrete foundations, anchors, grouting, pumps, drivers, power supply, seal water units, and controls.

##### 3.1.2 Concrete

Concrete shall conform to Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

### 3.2 PAINTING

Pumps and motors shall be thoroughly cleaned, primed, and given two finish coats of paint at the factory in accordance with the recommendations of the manufacturer. Field painting required for ferrous surfaces not finished at the factory is specified in Section 09900 PAINTING, GENERAL.

### 3.3 FIELD TESTING AND ADJUSTING EQUIPMENT

#### 3.3.1 Operational Test

Prior to acceptance, an operational test of all pumps, drivers, and control systems shall be performed to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that the equipment is not electrically, mechanically, structurally, or otherwise defective; is in safe and satisfactory operating condition; and conforms with the specified operating characteristics. Prior to applying electrical power to any motor driven equipment, the drive train shall be rotated by hand to demonstrate free operation of all mechanical parts. Tests shall include checks for excessive vibration, leaks in all piping and seals, correct operation of control systems and equipment, proper alignment, excessive noise levels, and power consumption.

#### 3.3.2 Retesting

If any deficiencies are revealed during any test, such deficiencies shall be corrected and the tests shall be reconducted.

### 3.4 MANUFACTURER'S SERVICES

Services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment specified shall be provided. The representative shall supervise the installation, adjustment, and testing of the equipment.

### 3.5 POSTING FRAMED INSTRUCTIONS

Framed instructions containing wiring and control diagrams under glass or in laminated plastic shall be posted where directed. Condensed operating instructions, prepared in typed form, shall be framed as specified above and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the system.

### 3.6 FIELD TRAINING

A field training course shall be provided for designated operating and maintenance staff members. Training shall be provided for a total period of 4 hours of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the items contained in the operating and maintenance manuals.

-- End of Section --

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SECTION 11375N

AERATION EQUIPMENT and TUBING

08/01

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## SECTION 11375N

AERATION EQUIPMENT and TUBING  
08/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

## AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C600 (1993) Installation of Ductile-Iron Water Mains and Their Appurtenances

## 1.2 QUALITY ASSURANCE

## 1.2.1 Rearing Pond and Raceway Component Drawings

Show construction details for each component and piece of equipment, including blower assembly, diffuser piping layout, support slab, appurtenances, and all piping and wiring in both the raceways and 0.5 acre rearing ponds.

## 1.2.2 Excavation and Backfilling

Include specific instructions for excavation and backfilling as interrelated to facility installation.

## PART 2 PRODUCTS

## 2.1 GENERAL REQUIREMENTS

## 2.2 HATCHERY REARING PONDS AND RACEWAYS

The rearing ponds and raceways shall include aeration equipment diffuser tubing, and other related facilities, as required.

## 2.3 AERATION EQUIPMENT

## 2.3.1 General

The aeration system shall be of the diffused air type capable of transferring not less than 1.0 lb of oxygen to the pond and raceway contents via coarse bubble diffusion.

## 2.3.2 Diffused Air Aeration Equipment

Aeration equipment shall include diffuser piping air blower assembly, piping and accessory items as specified hereinafter. Diffuser piping shall be of the coarse bubble type. The oxygen transfer capacity of the diffuser piping shall be capable of furnishing an adequate supply of oxygen to meet the dissolved oxygen requirements in the rearing ponds and raceways.

### 2.3.2.1 Air Diffusion Piping

Coarse Bubble Diffuser Piping: Coarse bubble diffuser piping shall be of the slotted piping type. The piping shall be self-weighted polyethylene tubing, with 1/2" ID. The piping shall be provided with an encapsulated lead keel to keep tubing submerged. Piping shall be "Air-Aqua 1/2" Weighted Tubing" by Eagar, Inc., or engineer approved equal.

### 2.3.2.2 Air Blower Assembly

Air blower assembly shall be as specified in Section 15400A: PLUMBING, GENERAL PURPOSE.

### 2.3.2.3 Piping

Piping shall include piping from air blower assembly to rearing ponds and raceways, air header piping and drop piping (piping from air header to diffuser piping). Materials for piping and valves shall be as specified in specification section 15200A PIPELINES; LIQUID PROCESS PIPING.

## PART 3 EXECUTION

### 3.1 DESIGN

The 0.5 acre rearing ponds and raceways shall be aerated by diffused air tubing. A minimum of 800 feet of tubing shall be utilized per 0.5 acre rearing cell. The tubing shall be arranged in a serpentine fashion across the basin floor. A total of eight cells shall be provided with the diffused air tubing. A minimum of eighty feet of tubing shall be provided for each raceway. A total of eight raceways (plus one raceway if the option "Canopy and raceway" is awarded) shall be provided with tubing. Sufficient oxygen shall be provided to prevent fish mortality. Oxygen demand shall be calculated assuming demand from algae, fish food, respiration, and fish waste.

### 3.2 INSTALLATION

#### 3.2.1 General

Installation work shall include construction of the air piping support structure(s); setting and anchoring of the aeration lines as necessary; installation of piping from blowers to air header; and installation of electrical wiring from electrical control system enclosure to motors and installation of electrical service to the electrical control system enclosure. The installation work covered by this section also includes earthwork operations as interrelated to rearing pond installation.

#### 3.2.2 Piping

Piping shall be installed to true alignment and rigidly supported. Mechanical joints shall be made in accordance with the requirements of AWWA C600. Flanged joints shall be made up tight, care being taken to avoid undue strain on flanges, valves, fittings and other equipment and accessories. Screwed joints shall be made up tight with a stiff mixture of graphite and oil, inert filler and oil, or an approved graphite compound, applied to the male threads only. Threads shall be full cut; not more than three threads on the pipe shall remain exposed.

### 3.3 FIELD TESTS AND INSPECTIONS

3.3.1 Plant Equipment

All mechanical and electrical units shall be operated and tested as specified herein. Should any defects that occur before or during the tests, shall be remedied and changes or replacement of equipment shall be made as may be necessary to comply with these specifications.

3.3.2 Hatchery Start-Up

The adjusting of equipment shall be made as required. The equipment shall be examined to determine if it is structurally sound. All defects noted shall be reported and corrected. If no defects are detected, this shall be reported.

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03/93

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## SECTION 11376

ULTRAVIOLET DISINFECTION EQUIPMENT  
03/93

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C82.4 (1992) Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple Supply Type)

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (1997) Enclosures for Electrical Equipment (1000 Volts Maximum)

NEMA ICS 1 (1993) Industrial Controls and Systems

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

## 1.2 SYSTEM DESCRIPTION

The ultraviolet (UV) disinfection system shall be complete and operational with controls and accessories as shown and as specified. The UV system and disc filter shall be provided as a unit. The equipment manufacturer shall be registered by the Environmental Protection Agency for UV Sterilizers. Equipment shall be suitable for gravity flow installation and shall include, but not be limited to, the following components, and appurtenances necessary for the interconnection of components, in the quantities required:

- (1) UV lamp module.
- (2) UV system instrumentation, controls, and power distribution.
- (3) Wireway and interconnecting cables.
- (4) Water level control device.
- (5) UV intensity monitoring system.
- (6) Elapsed time meter.
- (8) Spare parts.
- (9) Support framing.
- (10) Piping connections.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office

that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Layout; G-DO  
Installation; G-DO

Drawings showing fabrication methods, assembly, accessories, installation details and point-to-point wiring diagrams; instrumentation and controls; equipment; dimensions; make and model; materials of construction; and installation instructions. Drawings shall indicate clearances required for maintenance and operation and shall also contain complete wiring and schematic diagrams, equipment layout, dimensions, templates and directions for the installation of anchor bolts and other anchorages and any other details required to demonstrate that the system has been coordinated and will properly function as a unit.

SD-03 Product Data

Ultraviolet Disinfection Equipment; G-DO

Manufacturer's descriptive data, technical literature, and catalog cuts. Submittal shall include: design calculations relevant to the type of system proposed indicating removal performance including dose; nominal average intensity within each reactor; UV density; theoretical retention time of effluent within the system; dispersion coefficient; maximum headloss caused by each bank of lamp modules; lamp module cross-sectional area; aspect ratio of lamp bank; installation list; and manufacturer's illustrations.

Framed Instructions; G-AO

Proposed diagrams, instructions, and other sheets, prior to posting.

Field Training; G-AO

A proposed lesson plan of field instruction, 30 days prior to commencement of scheduled training.

Equipment; G-DO  
Adjusting and Cleaning; G-DO

A statement by the equipment manufacturer listing any exception to or deviations from the contract drawings and specifications.

Parts list including recommended spare parts and maintenance supplies with current unit prices and source of supply for each item of operable equipment. List shall include: parts recommended by the manufacturer to be replaced after 1 and 3 years of service. List special tools, instruments, accessories, and special lifting and handling devices required for periodic maintenance, repair, adjustment, and calibration.

SD-06 Test Reports.

## Laboratory Tests; G-DO

Hydraulic test results demonstrating hydraulic characteristics will allow the unit to function as required under the indicated head conditions.

## Testing; G-AO

Report in booklet form, upon completion of testing of the installed system. Test report shall include field tests performed to adjust each component and field tests conducted to prove compliance with the specified performance criteria. Test report shall indicate the final position of controls.

## SD-07 Certificates

Manufacturer's Qualifications; G-DO  
Standard Products; G-DO

Written evidence that equipment and accessories are products of a qualified and experienced manufacturer.

## SD-10 Operation and Maintenance Data.

## UV Disinfection System; G-DO

Six complete copies of operating instructions outlining the step-by-step procedures required for system startup, normal operation, short- and long-term deactivation, and shutdown. An introduction and overall equipment description, purpose, functions, and simplified theory of operation shall be included in the beginning of the instructions. Instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of each piece of equipment and its basic operating features. Instructions shall include component layouts, simplified wiring, and control diagrams for the system as installed. Performance test data shall be reflected in the operating instructions.

Six complete copies of maintenance instructions listing routine maintenance procedures, calibration procedures, possible breakdowns and repairs and trouble shooting guides, prior to the start of the training course.

Each manual shall have an index listing the contents and tab separators between sections. Manuals shall be bound in sturdy three-ring, loose-leaf binders.

## 1.4 QUALIFICATIONS

## 1.4.1 Contractor

Contractor shall have a minimum of 3 years experience in the construction of water, wastewater, and/or industrial wastewater facilities. Work includes furnishing all materials, equipment, and labor necessary to properly install and adjust the ultraviolet disinfection system to a complete and operational status as specified herein and as shown on the Contract drawings. The disinfection system shall be provided as a packaged unit, in conjunction with the disc filtration equipment specified in

Section 11377 DISC FILTRATION EQUIPMENT. One supplier shall be responsible for supplying both the disc filtration system, as well as the disinfection system. The units shall be coordinated via control elements as defined by the equipment manufacturer.

#### 1.4.2 Manufacturer's Qualifications

Manufacturer shall have experience in the production of substantially similar equipment, and shall show evidence of satisfactory operation of similar equipment to that proposed in at least 3 installations for a period not less than one year disinfecting water with similar flow and influent characteristics to the hatchery facility in this contract. One supplier shall be responsible for supplying both the disc filtration system, as well as the ultraviolet disinfection system. The units shall be coordinated via control elements as defined by the equipment manufacturer and as indicated in the drawings.

#### 1.5 PREINSTALLATION CONFERENCE

Preinstallation conference will be required by the Contracting Officer. The Contractor attendees shall include subcontractors, suppliers, and UV equipment manufacturer.

#### 1.6 DELIVERY, HANDLING AND STORAGE

Equipment and materials delivered, handled, and placed in storage shall be protected from damage, deterioration, weather, excessive humidity, excessive temperature variation, dirt, dust, and contaminants from the time of shipment until installation is completed and the equipment and materials are ready for operation. Equipment shall be marked and stored to permit easy identification and inspection. Each item of the equipment shall be tagged or marked as identified in the delivery schedule or on the shop drawings. Complete packing lists and bills of materials shall be included with each shipment.

#### 1.7 QUALITY ASSURANCE

##### 1.7.1 Equipment

Parts shall be manufactured to standard sizes and gauges so that repair parts furnished at any time can be installed in the field. Like parts of duplicate units shall be interchangeable. The ultraviolet disinfection unit shall be provided in a fiberglass or passivated stainless steel enclosure, with a fiberglass or passivated stainless steel lid covering the UV system. Other materials of construction for the enclosure and cover are not acceptable. Unless otherwise approved, the support framing shall be constructed of galvanized structural steel shapes and fasteners, designed to carry the vertical load as well as a horizontal force equal to 30% of the system's weight, and shall be anchored to the mezzanine. The support framing need not be painted. Also see mezzanine structural drawings for limits on concentrated loads.

##### 1.7.2 Performance

The installed UV system shall produce an effluent which meets the bacteriological requirements of this specification. The effluent quality exiting the system shall be equal to or better than the specification requirement.

## 1.8 FIELD MEASUREMENTS

The Contractor shall become familiar with details of the work, shall verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

## 1.9 EXTRA MATERIALS

Spare parts shall be new, exact replacements, and separately packaged. Package shall have bill of materials with quantity, item description, and part number. The following spare parts and safety equipment shall be furnished:

- a. Ten percent of the total number of lamps furnished for the system.
- b. Five percent of the total number of ballasts furnished for the system.
- c. Ten percent of the total number of lamp sleeves furnished for the system.
- d. Ten sets of lamp end seals.
- e. Ten sets of lamp socket connectors.

## PART 2 PRODUCTS

### 2.1 DESIGN CONDITIONS

#### 2.1.1 Effluent Characteristics

Ultraviolet equipment shall disinfect raw water with the following characteristics:

- a. Peak flow; 2,500 gpm total flow; 1,250 gpm each train.
- b. Average flow; 500 to 800 gpm
- c. Minimum flow; 50 gpm
- d. Total suspended solids (TSS), mg/L: <1 mg/L

#### 2.1.2 Performance Requirements

##### 2.1.2.1 UV Dose

The UV dosage shall be not less than 90,000 microwatt-seconds per square cm based on peak design flow conditions, lamp output at 60 percent of its initial level after 1 year (8750 hours) of lamp operation without fouling on the lamp sleeves, and minimum UV transmittance.

##### 2.1.2.2 Nominal Average Intensity

The nominal average intensity shall be not less than 90,000 microwatts per square cm at a transmittance of 80 percent after 100 hour burn-in of lamps and with no fouling on the lamp sleeves.

##### 2.1.2.3 UV Density

The UV density of the channel shall be not less than 2 watts/liter at the

end of lamp life.

#### 2.1.2.4 Retention Time

The actual retention time ( $t$ ) of the effluent within the system determined by hydraulic analysis shall be not less than 0.9 times the theoretical retention time ( $T$ ).

#### 2.1.2.5 Plug Flow

The flow characteristics through the system shall closely simulate ideal plug flow conditions under the full operating flow range. The Morrill Dispersion Index, defined as the time required for 90 percent of the salt and dye traces to pass, divided by the time required for 10 percent to pass, shall be less than 2.0. The ratio of the time required for 50 percent of tracer to pass to the mean residence time shall have a value between 0.9 and 1.1. The ratio of the time of initial tracer appearance to the theoretical residence time shall have a value greater than 0.5.

#### 2.1.2.6 Dispersion

The dispersion coefficient, which accounts for the deviation of the channel's hydraulic behavior from that of perfect plug flow, shall be less than 100 square cm per second. The dispersion number (ratio of the dispersion coefficient to the product of flow velocity and channel length) shall be less than 0.1.

#### 2.1.2.7 Turbulence

Flow through the system shall be turbulent with a Reynolds Number greater than 4,000 at average flow.

#### 2.1.2.8 Channel Volume

Full use shall be made of the reactor vessel throughout the flow range. The ratio of the mean residence time ( $\theta$ ) to theoretical residence time ( $T$ ) shall be greater than 0.9.

#### 2.1.2.9 Headloss

The headloss caused by each bank of lamp modules shall be such that at the peak flow rate no lamp is exposed to the atmosphere and the maximum depth over the uppermost lamp sleeves is 1.5 inches. The headloss through the reactor vessel shall not exceed 2 inches.

### 2.2 EQUIPMENT

#### 2.2.1 Layout

The physical layout of the system shown is based on equipment manufactured by Water Management Technologies, Inc. UV equipment provided shall be IMF Model 1250 Low Pressure Ultraviolet Disinfection system in a fiberglass enclosure, or engineer approved equal. If UV equipment proposed is different than that shown, the Contractor shall submit detailed, modified layout drawings and descriptions for approval by the Contracting Officer within 5 working days following Notice to Proceed. Proposed modifications shall ensure that the revised equipment will not exceed the floor dimensions defined in the Contract drawings. Contractor shall be responsible for any structural or equipment revisions necessary to

accommodate equipment varying from that indicated.

#### 2.2.2 Standard Products

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate equipment that has been in satisfactory operation for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

#### 2.2.3 Materials

Metal in contact with effluent shall be either Type 316 or Type 304 stainless steel, passivated. Wiring which may be exposed to UV light shall be of a material that resists degradation by UV light. Material exposed to UV light shall be stainless steel, passivated; quartz; polytetrafluoroethylene or other UV resistant material.

#### 2.2.4 Equipment Construction

##### 2.2.4.1 UV Lamp Module

- a. Module shall consist of lamps with each lamp placed in an individual sleeve. Module shall be capable of being replaced without interrupting operation of any other module.
- b. Horizontal lamp module shall have lamps in sleeves sealed and supported in a frame. Electrical wires which carry power to the lamps and ballasts shall be completely enclosed in the frame and shall be isolated from the water, or the system shall be provided with a non-submerged connection.
- c. System shall allow for complete system shutdown or by-pass. System shall allow continuous disinfection while replacing lamps and ballasts.

##### 2.2.4.2 UV Lamps

- a. Lamp shall be low-pressure mercury vapor type of the hot-cathode, instant-start design in which the coiled filamentary cathodes are heated by the arc current. The filament shall be a clamped design, and shall withstand shock and vibration.
- b. Lamp shall have the following characteristics:
  - (1) 90 percent of UV radiation shall be within the wavelengths of 233.7 to 273.7 nm.
  - (2) Produce a minimum UV intensity of 175 microwatts per square cm at a distance of 1 meter.
  - (3) Maximum power input of 200 watts (not including ballast losses).
  - (4) Have a minimum arc length of 60 inches.
  - (5) Rated to produce zero levels of ozone.

(6) Have a minimum UV output of 60 to 65 watts at 100 hours.

- c. Lamp base shall be metal and ceramic, resistant to UV light and ozone. Lamp tube shall be capable of transmitting 90 percent of the radiation produced therein.
- d. Changing lamps shall not require removal of the sleeve from the lamp module frame. Lamp ballast shall be capable of being replaced by plant operating personnel.

#### 2.2.4.3 UV Lamp Sleeve

- a. Sleeve shall be clear fused quartz circular tubing. Sleeve shall be rated for transmittance of 89 percent or more and sleeve shall not be subject to solarization over its life. The nominal wall thickness shall be between 0.8 and 2.09 mm.
- b. One end of each sleeve shall be closed and the other end sealed by a lamp end seal and compressed O-ring. The closed end of the sleeve shall be held in place by means of a retaining O-ring.

#### 2.2.4.4 Lamp End Seal and Lamp Holder

- a. The open end of the lamp sleeve shall be sealed by means of a PVC or nylon nut which compresses an external sleeve O-ring seal. The sleeve nut shall have a surface which allows a positive hand grip for tightening and shall not require any tools for removal.
- b. The lamp holder shall be held in place in such a way as to isolate and seal the lamp from the module frame and other lamps in the module. Should a lamp sleeve fracture, the seal shall prevent moisture from entering the module frame and the electrical connections to other lamps in the module.

#### 2.2.5 Lamp Array Configuration

- a. Horizontal lamp configuration shall be a uniform array with lamps parallel to each other and parallel or perpendicular to the flow. Lamps shall be evenly spaced or spaced in a 4" x 5" grid in horizontal and vertical rows.

#### 2.2.6 Water Level Control

- a. A level control device shall be placed at the discharge end of each treatment unit. Level control device shall maintain constant water level within tolerances required to keep lamps submerged and shall prevent excessive water layer over the top lamps. This may be accomplished through the inclusion of a weir or gooseneck piping configuration at the unit discharge.
- b. A water level sensor shall be situated within the channel to provide an alarm indication and/or automatic system shutdown should the water level drop below the uppermost part of the top row of horizontal lamps. Alarm contacts for remote annunciation shall also be provided.

#### 2.2.7 Nameplates

Major equipment items shall have the manufacturer's name, address, type or

style, model or serial number, and catalog number on a plate secured to the item of equipment.

## 2.3 ELECTRICAL

### 2.3.1 General

- a. The system shall be divided into the proper number of parallel electrical subsystems for the peak design flow.
- b. Each electrical subsystem shall be powered from a distribution center and shall include ground fault circuit detection, circuit protection, modules, and interconnecting cables.
- c. One power panel shall be supplied for each module and shall be prewired by the manufacturer, except for the final connection of the individual modules to the power panel.
- d. Ground fault detection on incoming power shall be standard with the UV equipment manufacturer.
- e. Control and monitoring components and power supply shall be housed in NEMA enclosures. Internal components shall be sealed from the environment. System electronics to be used in an interior environment shall be housed in enclosures conforming to NEMA 250 Type 12. System electronics to be used in an exterior and corrosive environment, as defined in NEMA 250, shall be housed in enclosures conforming to NEMA 250 Type 4X or FRP NEMA 4X.
- f. Sufficient cooling shall be provided to ballasts. Magnetic ballasts shall have a minimum allowable air flow per ballast of 30 cfm.
- g. Wiring and electrical connections shall be protected against moisture to prevent electrical shorts or failure. Electrical installation and materials shall conform to NFPA 70. The unit shall be completely wired requiring only an external connection for a single external power supply and remote control.
- h. Controls and designations shall conform to NEMA ICS 1.

### 2.3.2 Interconnect Cables

- a. Multiconductor unshielded cable shall be suitable for outdoor installation.
- b. Insulation shall be thermoplastic rubber with operating range of minus 40 degrees F to 140 degrees F with low temperature flexibility and flame retardants.
- c. The UV stabilized jacketing shall be resistant to oils, chemicals, fuels, solvents, and to mechanical abuse and abrasion.
- d. Cable shall be supplied by the equipment manufacturer and shall be of sufficient length and number for a complete system.
- e. Cable shall be of a modular repairable type and shall allow for field replacement and repair of its components by plant operators.

### 2.3.3 Connectors and Receptors

Connector shall be watertight wiring for 4-pin in-line connection. The design shall allow fast and easy positive coupling and uncoupling. Connector shall be mounted out of possible flood-prone environments. Connector shall be of a "snap-on" design having no threads and shall allow for visual confirmation that the connection is locked in place.

### 2.3.4 Ballasts

Ballast shall conform to ANSI C82.4; shall be coordinated to the ballast supplies; shall be rated for the voltage indicated; and shall have a power factor of not less than 90 percent at a crest factor of 2.0 or less, and a voltage range of not less than plus or minus 10 percent. Ballast shall be suitable for operating at 5 degrees F and above. Magnetic ballast shall be located and/or enclosed in an environment not susceptible to the effects of heat, cold and moisture. Ballast shall be of a modular design allowing for quick disconnect and replacement by operators.

### 2.3.5 Instrumentation and System Controls

#### 2.3.5.1 Controls

Equipment shall be of the fully automatic program control type and shall be capable of receiving standard 4-20 mA control signals from the UV system effluent flowmeter. (Flowmeter shall be provided by UV supplier and shall be coordinated with connecting piping as required to ensure proper installation and sufficiently accurate flow sensing.) Control of 2 or more banks of modules shall be accomplished by turning lamp banks on and off or by dimming in proportion to flow variations. Controls shall continuously adjust the UV intensity automatically in proportion to flow. Controls shall require no manual attention other than adjustment of the required UV intensity. The ultraviolet disinfection system shall be provided with an automatic shutoff in the event the lid covering the unit process is opened.

#### 2.3.5.2 Lamp Status Indicators

- a. Indicators shall indicate the status whether ON/OFF of each lamp in the module being powered.
- b. Indicators shall indicate the status "POWER ON", only, in each module.
- c. The lamp monitoring system shall indicate the geometric location of each individual lamp and operating status of each lamp by means of a neon lamp or alpha-numeric data display (LED or LCD), or shall show status on the UV disinfection unit for individual lamp status.

#### 2.3.5.3 UV Intensity Detection System

- a. A submersible UV sensor shall continuously sense the UV intensity at two separate locations within each UV disinfection unit. The fitting shall be made via a 0.75" male fitting with the intensity meter attached within that fitting. The sensor shall measure only the germicidal portion of the light emitted by the lamps within the channel between 254.5 and 255.0 nm. The UV intensity shall be displayed on the intensity meter. The probe shall be factory calibrated with verification in the field prior to startup. The

UV equipment manufacturer shall provide justification for the sensor location.

- b. Two UV intensity meters shall be provided per UV system. The meter shall indicate safe intensity, low intensity, and unsafe intensity by means of color codes on the meter face, or have a 0 to 100 percent scale. The UV intensity meter shall be clearly labeled and located on the remote control panel.
- c. An elapsed time meter shall be provided per bank of lamp modules, accessible via LED touchpad interface, password protected. The meter shall record hours of UV bank operation from 0 to 99,999 hours.
- d. One hand/off/auto switch shall be provided for each UV bank shown and specified.
- e. Alarms shall be time delayed to prevent nuisance alarms.

#### 2.3.5.4 Minor Alarms

Minor alarms and dry contacts shall be provided to indicate that maintenance attention is required. Minor alarms shall include:

- a. Low warning UV intensity.
- b. Individual lamp failure.

#### 2.3.5.5 Major Alarms

Major alarms and dry contacts shall be provided to indicate an extreme condition in which the disinfection performance may be jeopardized. Major alarms shall include:

- a. Low UV intensity.
- b. Lamp failure of 2 or more adjacent lamps.
- c. Multiple lamp failure.
- d. Module failure.

#### 2.3.5.6 Flow Pacing

- a. A flow pacing system shall be provided to turn the UV banks on and off or to dim lamps in relationship to the signal received from the UV system effluent flowmeter. Flow pacing sequence shall be as recommended by the UV equipment manufacturer. Where lamp dimming is used, a controller shall be provided to allow plant operator to ratio the flow to UV dosage and UV intensity. Where on/off control is used, the system shall allow the operator to vary the flowrate setting and allow the operator the option to operate individual banks in either the manual or automatic mode. Logic and time delays shall be provided to regulate the UV bank ON/OFF cycle to prevent excessive cycling on both startup and shutdown of the UV bank. Multicycle lamps may be specified in applications which demand up to 100,000 annual cycles.
- b. Normal mode of operation shall place each UV system continuously

in service.

## 2.4 FRAMED INSTRUCTIONS

Framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form and posted beside the diagrams.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Installation shall be in accordance with the drawings, shop drawings, and manufacturer's instructions and recommendations.

### 3.2 MANUFACTURER'S SERVICES

#### 3.2.1 Manufacturer's Representative

Services of a qualified manufacturer's field service representative shall be provided. The representative shall supervise the installation, adjustment, testing of equipment and instruct plant operators in the care, operation, and maintenance of the equipment.

#### 3.2.2 Site Visits

Manufacturer's representative shall assist in the proper installation and checking of the equipment for a period of time necessary to insure a completed installation. The representative shall, for a period not less than three full days, start up the equipment, supervise initial operations, perform the required field tests and instruct plant operators in the proper care, operation and maintenance of the equipment. Upon request of the Government, at any time during the 1-year warranty period, the representative shall recheck the system, recalibrate and adjust equipment, answer plant operator's questions and review operation and maintenance procedures.

#### 3.2.3 Field Training

Instruction shall be a combination of classroom and hands-on training at the site. Representative shall instruct designated maintenance and operations personnel in the recommended corrective and preventive maintenance procedures for the equipment. Field training shall cover each item contained in the operating and maintenance manuals.

##### 3.2.3.1 Instruction Lesson Plan

A lesson plan shall be prepared which shall include the elements presented in the outline specified below. Specific components and procedures shall be identified in the proposed lesson plan. Specific instruction topics shall be detailed. Training aids to be utilized in the instruction shall be referenced and attached where applicable to the proposed lesson plan. Hands-on demonstrations planned for the instruction and estimated duration of each segment of the training shall be described in the lesson plan. The elements presented in the following outline shall be included in the

instruction as a minimum:

- a. Equipment operation.
- b. Detailed component description.
- c. Equipment preventative maintenance.
- d. Equipment troubleshooting.
- e. Equipment corrective maintenance.
- f. Hands-on demonstrations.

### 3.3 ADJUSTING AND CLEANING

Equipment shall be tested, calibrated, adjusted and operated to verify its satisfactory operation. Equipment shall be cleaned of dirt, dust and foreign matter.

### 3.4 TESTING

#### 3.4.1 Field Testing

After Contractor and Contracting Officer have mutually agreed that the equipment installation is complete and ready for continuous operation, Contractor shall conduct an operating test of the equipment and controls in the presence of the Contracting Officer to demonstrate satisfactory operation.

#### 3.4.2 Performance Testing

- a. After the UV equipment has been installed and field tested, the Contractor shall begin performance testing. Samples shall be collected at times when the flow through the process area is at or near the peak flow rating for an individual unit. Where multiple systems are supplied, the process flow shall be at or near the peak flow rating of at least one system or one section of the UV system.
- b. The samples collected shall be analyzed for the following, using standard testing methods or procedures:
  - (1) Total suspended solids prior to disinfection.
  - (2) Percent UV transmittance at 254 nm with 1 cm cell length prior to disinfection.
- c. Performance testing shall continue for 3 days and samples shall be collected 1 times per 24 hour period. The data obtained shall be recorded in booklet form. Test reports shall indicate the final position of controls.
- d. The effluent quality exiting the UV unit shall be equal to or better than the specification requirement. Retesting shall continue for at least 2 consecutive days or until satisfactory bacteriological results have been obtained.

-- End of Section --



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SECTION 11377

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## SECTION 11377

## DISC FILTRATION EQUIPMENT

02/03

## PART 1 GENERAL

## 1.1 SYSTEM DESCRIPTION

The disc filtration system shall be complete and operational with controls and accessories as shown and as specified. Equipment shall be suitable for gravity flow installation and shall include, but not be limited to, the following components and appurtenances as necessary for the interconnection of components, in the quantities required:

- (1) Disc Filtration unit
- (2) Automatic backwash system
- (3) Water level control system
- (4) Spare parts
- (5) Support framing

Work includes furnishing all materials, equipment, and labor necessary to properly install and adjust the rotating disc microstrainer to a complete and operational status as specified herein and as shown on the Contract drawings. The disc filtration unit shall be provided as a packaged unit, in conjunction with the ultraviolet disinfection system specified in Section 11376 ULTRAVIOLET DISINFECTION EQUIPMENT. One supplier shall be responsible for supplying both the disc filtration system and the disinfection system. The units shall be coordinated via control elements as defined by the equipment manufacturer and as required to function with instrumentation and controls as specified and as indicated on the drawings.

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Layout; G-DO  
Installation; G-DO

Drawings showing fabrication methods, assembly, accessories, installation details and point to point wiring diagrams; instrumentation and controls; equipment; dimensions; make and model; materials of construction; openings and connections; and installation instructions. Drawings shall indicate clearances required for maintenance and operation and shall also contain complete wiring and schematic diagrams, equipment layout, dimensions, templates and directions for the installation of anchor bolts and other anchorages and any other details required to demonstrate that the system has been coordinated and will properly function as a unit.

## SD-03 Product Data

## Disc Filtration Equipment; G-DO

Manufacturer's descriptive data, technical literature, weights of major components, and catalog cuts. Submittal shall include: Design calculations relevant to the type of system proposed indicating removal performance; maximum headloss obtained through the unit, and manufacturer's illustrations. Submit adjustments relating to dimensional, elevational, and structural support changes required for operation and maintenance of alternate, approved equal, equipment as defined in paragraph 2.3 of this specification.

Equipment; G-DO  
Adjusting and Cleaning; G-DO

A statement by the equipment manufacturer listing any exception to or deviations from the contract drawings and specifications.

Parts list including recommended spare parts and maintenance supplies with current unit prices and source of supply for each item of operable equipment. List shall include: Parts recommended by the manufacturer to be replaced after one and three years of service. List special tools, instruments, accessories, and special lifting and handling devices required for periodic maintenance, repair, adjustment, and calibration.

## SD-06 Test Reports

Testing; G-AO

Report in booklet form, upon completion of testing of the installed system. Test report shall include field test performed to adjust each component and field test conducted to prove compliance with the specified performance criteria. Test report shall indicate the final position of controls.

## SD-10 Operation and Maintenance

Disc Filtration System; G-DO

Six complete copies of operating instructions outlining the step-by-step procedures required for system startup, normal operation, short- and long-term deactivation, and shutdown. An introduction and overall equipment description, purpose, functions, and simplified theory of operation shall be included in the beginning of the instructions. Instructions shall include the manufacturer's name, model number, service manual, parts list and brief description of each piece of equipment and its basic operating features. Instruction shall include component layouts, simplified wiring, and control diagrams for the system as installed. Performance test data shall be reflected in the operating instructions.

Six complete copies of maintenance instruction listing routine maintenance procedures, calibration procedures, possible breakdowns and repairs and trouble shooting guides, prior to the start of the training course.

Each manual shall have an index listing the contents and tab separators between sections. Manuals shall be bound in sturdy three-ring, loose-leaf binders.

## 1.3 QUALIFICATIONS

## 1.3.1 Contractor

Contractor shall have a minimum of three years experience in the construction of aquaculture, water, wastewater, and/or industrial treatment facilities.

#### 1.3.2 Manufacturer's Qualifications

Manufacturer shall have experience in the production of substantially similar equipment and shall show evidence of satisfactory operation of identical equipment to that proposed in at least three installations for a period not less than one year for filtering water with similar flow and influent characteristics for aquaculture systems.

#### 1.4 QUALITY ASSURANCE

##### 1.4.1 Equipment

Rotating disc microstrainers shall be Hydrotech Model 1706/04 (121 ft<sup>2</sup> expandable to 181 ft<sup>2</sup>); four discs installed, with tank; or engineer approved equal.

All equipment shall comply with applicable codes.

#### 1.5 PRECONSTRUCTION CONFERENCE

Preinstallation conference will be required by the Contracting Officer. The Contractor attendees shall include subcontractors, suppliers, and disc filtration equipment manufacturer.

#### 1.6 DELIVERY, HANDLING, AND STORAGE

Equipment and materials delivered, handled, and placed in storage shall be protected from damage, deterioration, weather, excessive humidity, excessive temperature variation, dirt, dust, and contaminants from the time of shipment until installation is completed and the equipment and materials are ready for operation. Equipment shall be marked and stored to permit easy identification and inspection. Each item of the equipment shall be tagged or marked as identified in the delivery schedule or on the shop drawings. Complete packing lists and bills of materials shall be included with each shipment.

#### 1.7 EXTRA MATERIALS

Spare parts shall be new, exact replacements, and separately packaged. Package shall have bill of materials with quantity, item description, and part number. The following spare parts shall be furnished:

- a. One complete set of filter elements
- b. Special tools as required to maintain the filters.
- c. Grease
- d. 10 - Nylon spray caps
- e. 10 - Stainless steel spray nozzles

## PART 2 PRODUCTS

### 2.1 DESIGN CONDITIONS

#### 2.1.1 Effluent Characteristics

The disc filtration system shall filter raw water with the following characteristics:

Water flow rate, per filtration unit (two units total) Maximum  
= 1250 gpm  
Minimum flow rate = 100 gpm  
Water temperature Maximum = 72 degrees F  
Minimum = 38 degrees F  
Design Life Minimum = 20 years

Influent inorganic chemical concentrations of raw water from the dredge cut area shall be as follows:

pH	6.5 Minimum 7.7 Average 8.8 Maximum
Total Hardness	270 mg/L Maximum as CaCO <sub>3</sub> 244 mg/L Average
Total alkalinity	184 mg/L Maximum as CaCO <sub>3</sub> 158 mg/L Average
Total Dissolved Solids	424 mg/L Maximum 354 mg/L Average
Total Suspended Solids	10 mg/L Maximum 4 mg/L Average
Iron	0.16 mg/L Maximum 0.09 mg/L Average
Manganese	0.009 mg/L Maximum 0.006 mg/L Average
Sulfate	134 mg/L Maximum 154 mg/L Average

### 2.1.2 Performance Requirements

A total of two rotating disc microstrainer's will be provided under this contract. Each rotating disc microstrainer shall be capable of continuous filtration of water under the following design parameters:

Process water flow rate: 1,250 gpm (each); total capacity =  
2,500 gpm  
Peak influent suspended solids loading (mg/l): 10 mg/l  
Screen size: 17 mm (micron)

## 2.2 EQUIPMENT

### 2.2.1 Rotating Disc Microstrainer.

The filtration system design is based on equipment manufactured by Water Management Technologies, Baton Rouge, LA. Specific design equipment utilized was Hydrotech Model 1706/04 (121 ft<sup>2</sup> expandable to 181 ft<sup>2</sup>); four discs installed, with tank enclosure. Alternate equipment is acceptable, providing the equipment is designed to operate as specified herein (including expansion capability), and critical components are accepted as

approved equivalents by the Government. In addition, if alternate equipment is to be provided, it is the Contractor's responsibility to verify and adjust as needed all affected dimensions, elevation and structural support systems to provide operation of the completed system equivalent to the original design. All adjustments are subject to review and approval by the Engineer. All rotating disc microstrainers shall be provided by a single manufacturer with the ability to document a minimum of five installations with similar flow rates and loading characteristics. The rotating disc microstrainer manufacturer shall review the installation drawings for the microstrainers. If special mounting sealing or support items are needed for proper installation, the microstrainer manufacturer shall provide these items as part of the equipment supplied.

### 2.2.2 System Operation

The rotating disc microstrainer shall operate by passing influent solid laden water into the interior of the disc cavity. Influent water shall flow by gravity through the filter elements causing solids to impinge on the interior side of the screen elements. The water level in the disc cavity will rise due to screen occlusion until a liquid level control mechanism activates a high pressure rinse bar to backwash the solids off the screen elements into a sludge trough. Simultaneously, a driveline shall turn the drum exposing all screen elements to the backwash spray. When the water level inside the drum drops back to normal, the liquid level control mechanism shall be disengaged and activate an off delay timer to ensure complete cleaning of filter elements. The cycle shall repeat itself on demand as the screen becomes loaded. The minimum water surface required inside the microstrainer tank to avoid excessive hydrostatic loading of the drum shall be provided by the tank's design. The units shall not require external control of the effluent water surface. The disc microstrainers shall be provided in a packaged system complete with all controls, sensors, motor starters, pumps, rinse system piping, electrical cabinets, and components as specified herein. Appropriate lengths of conduit and wiring shall be included for installation as shown on the contract drawings. The units shall be pre-wired, plumbed, and assembled in the factory to the greatest extent possible. The disc filtration unit shall be provided as a packaged unit, in conjunction with the ultraviolet disinfection system specified in Section 11376 ULTRAVIOLET DISINFECTION EQUIPMENT. One supplier shall be responsible for supplying both the disc filtration system, as well as the disinfection system. The units shall be coordinated via control elements as defined by the equipment manufacturer.

## 2.3 SYSTEM COMPONENTS

The Disc Filter shall consist of the drive-line, filter elements, disc structure, tank, spray bars, sludge trough, support bearings, liquid level control and high pressure rinse system.

### 2.3.1 Driveline

A helical worm gearbox shall be coupled to the disc filter drive shaft with #80 riveted roller chain and sprockets. The chain shall run in a continuous oil bath.

### 2.3.2 Filter Element

Disc filter elements shall have a 316SS frame with woven polyester filter cloth bonded to the frame with epoxy. Disc filter elements shall be secured to the disc frame individually with a retaining frame and one bolt

clamp. The filter element shall be sealed to the disc structure utilizing EDPM type gasket material to provide watertight closure. Filter element size shall be 17 micron. Capability shall be provided to enable replacing filter elements with 10 micron screens in the future. Filter manufacturer shall have 10 micron screens available as standard elements for equipment provided; however the 10 micron screens are not included in this contract.

### 2.3.3 Disc Structure

The disc filters shall have 4 disc frames per disc row respectively. Each disc frame shall hold the required number of filter elements. Each disc frame shall be secured to the disc trunk with one-bolt tee clamps through the slot opening, thus allowing easy removal. Each disc frame shall be sealed to the disc trunk utilizing EDPM type gasket material to provide a watertight closure.

### 2.3.4 Disc Support

The disc shall be supported on a three point bearing system utilizing idler wheels on the inlet end and an AISI 316SS drive shaft bolted to the disc trunk on the closed end. The end ring at the inlet side of the disc structure serves as the idler wheel track. Grease fitted roller bearings and POM bearing shall be used for the idler wheels and drive shaft, respectively.

### 2.3.5 Moving Spray Bar

Each disc row shall have two spray bars, one for each side. Each bar shall have nozzles with overlapping coverage for the disc filters. Quick-release nozzles shall be used for easy cleaning and maintenance. The materials of construction shall be a nylon quick release cap, EDPM gasket and stainless steel spray tip. The spray bars shall move with a belt driven cam off the drive shaft. The cam shall rotate the spray bar trunk line thus oscillating the spray coverage across the screen surface.

### 2.3.6 Sludge Trough

The trough shall be capable of capturing solids 150 from top dead center in each direction. Lateral arms attached to the disc frame shall support the sludge trough, permitting the disc to rotate unobstructed.

### 2.3.7 High Pressure Rinse System

The system shall consist of a booster pump, solenoid valve (if required), line strainer, and high pressure hose. Filtered water shall be used for backwashing. The filter shall be provided with a foot valve and Schedule 40 PVC fittings for the suction side of the backwash pump. The backwash system, including all required pumps, piping, level sensors, and controls shall be provided by the filter manufacturer. Appropriate lengths of 1/2" flexible non-metallic conduit with watertight connectors shall be provided for connection from the liquid level control to the booster pump and solenoid valve. The system shall be capable of supplying water to the filter backwash system nozzles at a pressure of 100 psi or greater at the flow required to clean the screens.

### 2.3.8 Tank.

Each microstrainer shall be provided in a tank mounted configuration. The tank system shall be water tight and constructed from stainless steel. The

tank shall be sized to accommodate future addition of discs as required to maintain specified flow when using 10 micron filter elements. An overflow integral with the tank shall be provided and piped to the overflow trough. The tank shall be supported by framing designed to carry the weight of the filter, filled with water, along with a horizontal force equal to 30% of the weight. See structural drawings for limits on mezzanine loading. Unless otherwise approved, the support framing shall be constructed of stainless or galvanized structural steel shapes and fasteners. The tanks, cover and support framing need not be painted.

#### 2.3.9 Cover.

Each microstrainer shall be provided with an easily removable cover, constructed of stainless steel, and designed specifically for the microstrainer provided.

#### 2.3.10 Alarms.

Each rotating disc microstrainer shall be provided with an alarm float switch. The high-level alarm setting shall be adjustable and set initially to activate the alarm as the water level rises two inches above the level setting that activates the backwash system.

#### 2.3.11 Liquid Level/Backwash Control

All electrical components shall be enclosed in a Hoffman A-161410CHQRFG NEMA 4X enclosure and include a fused disconnect switch, three position selector switch (hand-off-auto), drive VFD, booster pump starter/overload relay, 75 VA control voltage transformer, off delay relay, terminal blocks and 316SS magnetic float switch. Appropriate lengths of 1/2" flexible non-metallic conduit with watertight connectors shall be provided for connection to the gearbox and float switch.

The hand position immediately engages the drive VFD, booster pump starter/overload relay and solenoid valve. The rinse cycle runs continuously until the selector switch is returned to the off or auto position.

The auto position engages an off delay relay to sense water level with the 316SS float switch. When the water level reaches the float switch and closes its contacts the relay engages the drive VFD, booster pump starter/overload relay and solenoid valve to begin the rinse cycle. As the disc rotates clean filter elements enter the water stream thus lowering the water level and opening the float switch contacts. The off delay relay continues the rinse water cycle for a selected period of time before disengaging the drive VFD, booster pump starter/overload relay and solenoid valve to end the rinse cycle. Thus, ensuring complete cleaning of the filter elements. The system is reset to begin the next cycle.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Installation shall be in accordance with the drawings, shop drawings, and manufacturer's instructions and recommendations. The Contractor shall install the rotating disc microstrainer in strict accordance with the manufacturer's directions. The equipment shall be fully covered and protected at all times during installation and construction.

### 3.2 MANUFACTURER'S SERVICES

#### 3.2.1 Manufacturer's Representative

Services of a qualified manufacturer's field service representative shall be provided. The representative shall supervise the installation, adjustment, testing of equipment and instruct plant operators in the care, operation, and maintenance of the equipment.

#### 3.2.2 Site Visits

Manufacturer's representative shall assist in the proper installation and checking of the equipment for a period of time necessary to insure a completed installation. The representative shall, for a period not less than three full days, start up the equipment, supervise initial operations, perform the required field tests and instruct plant operators in the proper care, operation and maintenance of the equipment, including the UV system. Upon request of the Government, at any time during the 1-year warranty period, the representative shall recheck the system, recalibrate and adjust equipment, answer plant operator's questions and review operation and maintenance procedures.

#### 3.2.3 Field Training

Instruction itself shall be a combination of classroom and hands-on training at the site. Representative shall instruct designated maintenance and operations personnel in the recommended corrective and preventive maintenance procedures for the equipment, including UV units. Field training shall cover each item contained in the operating and maintenance manuals. The microstrainer manufacturer shall provide 16 hours of field startup and operator training services by a factory-trained representative.

### 3.3 TESTING

#### 3.3.1 Field Testing

After Contractor and Contracting Officer have mutually agreed that the equipment installation is complete and ready for continuous operation, Contractor shall conduct an operating test of the equipment and controls in the presence of the Contracting Officer to demonstrate satisfactory operation. The Contractor shall monitor head loss of the system under rated flow rates. Contractor shall provide all test equipment and labor for the test. Any damage resulting from or caused by the test shall be repaired at the Contractor's expense. All tests shall be performed under the supervision of the Owner's representative. A factory representative shall be available for consultation during the testing period.

### 3.4 WARRANTY

All components of the microstrainer, including controls and high pressure rinse system shall be warranted against labor and material defects for one year after start-up or 1.5 years from date of shipment.

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## SECTION 11378

## HATCHERY EQUIPMENT

02/03

## PART 1 GENERAL

## 1.1 SYSTEM DESCRIPTION

The following equipment shall be provided complete and operational with controls and accessories as shown and/or specified. Hatchery equipment shall be suitable for the anticipated operational situation, and shall include, but not be limited to, the following specific components and appurtenances as necessary for the interconnection and successful operation of the components, in the quantities required:

- (1) Incubation Jars (350 total)
- (2) Fiberglass Tankage (Circular-16 total; Rectangular-50 total)
- (3) Heath Tray Incubators (2)

Work includes furnishing all materials, equipment, and labor necessary to properly install and adjust the referenced equipment to a complete and operational status as specified herein and as shown on the Contract drawings.

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES.

## SD-02 Shop Drawings

Layout; G-DO  
Installation; G-DO

Drawings showing assembly, accessories, installation details and point to point wiring diagrams; instrumentation and controls (as necessary); equipment; dimensions; make and model; materials of construction; openings and connections; and installation instructions. Drawings shall indicate clearances required for maintenance and operation and shall also contain complete wiring and schematic diagrams, equipment layout, dimensions, and any other details required to demonstrate that the various systems have been coordinated and will properly function as a unit.

## SD-03 Product Data

Hatchery Equipment; G-DO

Manufacturer's descriptive data, technical literature, weights of fiberglass tankage, and catalog cuts. Submittal shall also include manufacturer's illustrations.

Equipment; G-DO  
Adjusting and Cleaning; G-DO

Parts list including recommended spare parts and maintenance supplies with current unit prices and source of supply for each item of operable equipment. List shall include: Parts recommended by the manufacturer to be replaced after one and three years of service. List special tools, instruments, accessories, and special lifting and handling devices required for periodic maintenance, repair, adjustment, and calibration.

#### SD-10 Operation and Maintenance

##### Hatchery Equipment Systems; G-AO

Where appropriate, six complete copies of operating instructions outlining the step-by-step procedures required for system startup, normal operation, and shutdown, such as for incubation equipment. Instructions shall include the manufacturer's name, model number, service manual, parts list and brief description of each piece of equipment and its basic operating features. Instruction shall include component layouts for the system as installed.

Where appropriate, six complete copies of maintenance instruction listing routine maintenance procedures, calibration procedures, possible breakdowns and repairs and trouble shooting guides.

Each manual shall have an index listing the contents and tab separators between sections.

### 1.3 QUALIFICATIONS

#### 1.3.1 Manufacturer's Qualifications

Manufacturer shall have experience in the production of substantially similar equipment and shall show evidence of satisfactory operation of identical equipment to that proposed in at least three installations for a period not less than one year for other aquaculture systems.

### 1.4 QUALITY ASSURANCE

#### 1.4.1 Equipment

All equipment shall comply with applicable suppliers, or engineer approved equal:

Incubation Jars: Midland Hatching Jar, Model MPC-300 Upwelling Incubator; 6.25" diameter, 18" height; to be provided with feeder tube and filter screen

Fiberglass Tankage: Water Management Technologies

Heath Tray Incubators: vertical incubator by Eagar, Inc., 16 tray rack; complete

### 1.5 DELIVERY, HANDLING, AND STORAGE

Equipment and materials delivered, handled, and placed in storage shall be protected from damage, deterioration, weather, excessive humidity, excessive temperature variation, dirt, dust, and contaminants from the time of shipment until installation is completed and the equipment and materials are ready for operation. Equipment shall be marked and stored to permit easy identification and inspection. Each item of the equipment shall be tagged or marked as identified in the delivery schedule or on the shop

drawings. Complete packing lists and bills of materials shall be included with each shipment.

## PART 2 PRODUCTS

### 2.1 EQUIPMENT PERFORMANCE REQUIREMENTS

The hatchery equipment provided under this specification will conform with the following requirements:

#### 2.1.1 Incubation Jars.

350 incubation jars total; 6.25" diameter; 16,000 egg capacity (3.5 quart minimum eyed egg capacity); 18" overall height; 0.75 inch inlet diameter.

#### 2.1.2 Fiberglass Tankage.

Circular-16 total; 12 foot diameter, 42 inch sidewall depth, 36 inch operating depth, non-skirted.

Rectangular-49 total; 3'wide x 4'sidewall depth (42" operating depth) x 12 feet length, non-skirted.

#### 2.1.3 Heath Tray Incubators.

Two - 16 tray vertical incubators. Provided with frame, trays and tray lids, clean-out rod with plug.

#### 2.1.4 System Operation

The specified equipment shall be provided in a packaged system complete with all controls, and components as specified herein. Appropriate lengths of conduit and wiring shall be included for installation as shown on the contract drawings. The units shall be pre-wired, plumbed, and assembled in the factory to the greatest extent possible. The units shall be coordinated via control elements as defined by the equipment manufacturer.

### 2.2 SYSTEM COMPONENTS

#### 2.2.1 Incubation Jars.

Incubation jars shall be designed for upwelling flow. Jars shall be constructed of non-corrosive, non-toxic plastic. Body to be clear. Water shall enter the incubator jar via an open-ended feeder tube in the center of the incubator. The incubator shall allow the eggs at the base to be rotated uniformly and precisely. Incubator shall be Midland Fish Hatching Jar, Model MPC-300, complete jar with screen and feeder tube, or engineer approved equal.

#### 2.2.2 Fiberglass Tankage (Circular-16 total; Rectangular-50 total)

Tanks furnished under this section shall be fabricated in full conformity with drawings, engineering data, instructions and recommendations of the fabricator. All tanks shall be provided without tank skirts.

Except as modified, all materials and construction methods shall comply with the applicable provisions of the following standards:

- a. NBS Voluntary Products Standard PS15-69
- b. ASTM C582 "Standard Specifications for Contact Molded Reinforced Thermosetting Plastic (RTP)Laminates for Corrosion Resistant Equipment."
- c. ASTM D4097 "Standard Specifications for Contact-Molded Glass-Fiber Reinforced Tanks."

Basic materials shall be as follows:

- a. Corrosion Resistant Isophthalic Gelcoat shall meet or surpass all requirements of ANSI Z124.1, .2, and .3.

<u>Physical Properties</u>	<u>Room Temperature (Cured for 45 hrs.)</u>
Tensile Strength, psi	6,215
Tensile Elongation, %	2.7
Flexural Strength, psi	11,363
Flexural Modulus, psi	544,000
Heat Distortion, Temp F	131

- b. Corrosion resistant isophthalic polyester resin ingredients shall comply with US Food and Drug Administration title 21CFR, parts 120-199 relative to FDA ingredients.

<u>Physical Properties</u>	<u>Room Temperature (Cured for 45 hrs.)</u>
Tensile Strength, psi	12,100
Tensile Modulus, psi	550,000
Tensile Elongation, %	2.8
Flexural Strength, psi	18,400
Flexural Modulus, psi	610,000
Heat Distortion, Temp F	224

- c. Reinforcement glass fiber
- d. Exposed metal shall be stainless steel.
- e. Protect all carbon steel metal with fiberglass reinforced plastic coating.

Tanks shall be constructed of varying hand laid layers of 1.5 ounce mat glass fiber reinforcement, woven roving glass fiber reinforcement, core material, and a single chemical resistant isophthalic resin throughout, in accordance with the applicable governing standard. The inner surface layer of each tank shall consist of a smooth layer of chemical resistant isophthalic gelcoat having a total finished thickness of no less than 20 mils.

Minimum overall wall thickness is 3/16".

### 2.2.3 Heath Tray Incubators

Vertical incubators shall have water enter the rear of a water tray, at the top of the cabine, upwell through the egg tray, and flow over the front wall inside the water tray into a channel which feeds the next lower tray. Each water tray shall be designed to slide easily forward on level tracks from the front of the cabinet. Individual trays may be entirely removed to

monitor egg and fry progress. Cabinets shall be stackable to form a 16-tray configuration. The cabinet shall be constructed of one-piece welded aluminum frame. Interior components are molded plastic. Screening materials shall be provided for salmon eggs.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Installation shall be in accordance with the drawings, shop drawings, and manufacturer's instructions and recommendations. The Contractor shall install the specified equipment in strict accordance with the manufacturer's directions. The equipment shall be fully covered and protected at all times during installation and construction.

#### 3.2 TESTING

##### 3.2 Field Testing

After Contractor and Contracting Officer have mutually agreed that the equipment installation is complete and ready for continuous operation, Contractor shall conduct an operating test of the equipment and controls in the presence of the Contracting Officer to demonstrate satisfactory operation. Contractor shall provide all test equipment and labor for the test. Any damage resulting from or caused by the test shall be repaired at the Contractor's expense. All tests shall be performed under the supervision of the Owner's representative.

#### 3.3 WARRANTY

All components of the equipment specified herein, including controls, shall be warranted against labor and material defects for one year after start-up or 1.5 years from date of shipment.

-- End of Section --

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SECTION 11393

BAG FILTRATION SYSTEM

06/01

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## SECTION 11393

BAG FILTRATION SYSTEM  
06/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M (2000) Carbon Structural Steel  
ASTM A 153/A 153M (2000) Zinc Coating (Hot-Dip) on Iron and Steel Hardware

## ASME INTERNATIONAL (ASME)

ASME B40.1 (1991) Gauges - Pressure Indicating Dial Type - Elastic Element

## INSTRUMENT SOCIETY OF AMERICA (ISA)

ISA S5.1 (1984; R 1992) Instrumentation Symbols and Identification

## THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PS 13.01 (1991) Epoxy-Polyamide Painting System  
SSPC SP 6 (1994) Commercial Blast Cleaning

## 1.2 SYSTEM DESCRIPTION

The filtration system shall be a bag filtration system. The filtration system shall be designed, constructed, and installed to comply with the following design conditions. The Contractor shall supply auxiliary systems and equipment required to maintain complete and workable filter systems including, but not limited to, required piping between units, auxiliary equipment for plumbing and power, and controls and interfaces between auxiliary equipment and the filter. Chemical additives will not be required to enhance the filtration system. The installation shall be constructed indoors.

## 1.2.1 Bag Influent

Maximum Flow Rate: 1000 gallons per minute  
Maximum Influent Temperature: 68 F  
Minimum Influent Temperature: 40 F

Flow Conditions: intermittent

Design Influent,  
Suspended Solids: 25 mg/L  
Design Effluent,  
Particle Size: 25 micron  
Source of Process Water: surface water

### 1.2.2 Bag Design Criteria

Total Number Operating Units: 2  
Number of On-line Units: 1  
Number of Stand-by Units: 1  
Number of Elements per Unit: 12  
Design Effluent,  
Particle Size: 25 micron  
  
Maximum Differential Pressure: 2.2 psi at design temperature  
2.2 psi at maximum temperature

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

##### Shop Drawings; G-DO

Shop drawings consisting of a complete list of equipment and materials, including manufacturer's descriptive and technical literature; performance charts and curves; catalog cuts; and installation instructions. Shop drawings shall also contain complete wiring and schematic diagrams; equipment layout and anchorage; and any other details required to demonstrate that the system has been coordinated and will properly function as a unit.

#### SD-03 Product Data

##### Posting Framed Instructions; G-AO

Proposed diagrams and instruction shall be submitted prior to posting.

##### Control System; G-DO

Detailed description of the proposed control system. The description shall include, but not be limited to, the following items:

a. Product information for sensors/transducers and field instruments.

b. The maintenance alarm incator.

(1) System Description

(2) Hardware Description

(3) Software Description (if applicable).

c. Panels, Consoles, and Cabinets Information

(1) Layout Drawings

(2) Panel schematic and internal point-to-point wiring interconnect and/or piping diagrams

(3) Electrical control schematics in accordance with JIC standards for all circuits indicated in the specifications or on the Contract Drawings. No "typical" wiring diagrams will be acceptable and no tables or charts to describe wire numbers will be acceptable. Wires shall be labeled and shown on the submittal drawings.

(4) Plan showing equipment layout.

(5) Stock lists or Bill of Materials for each panel including tag number, functional name, manufacturer's name, manufacturer's model number, and quantity for components mounted in and on the panel, console, or cabinet.

d. Field wiring and piping diagrams and point-to-point wiring diagrams including interconnections between field devices, panels, control stations, lighting panels, etc.

e. Instrument loop diagrams for analog display, control and I/O loops prepared using ISA standard symbols.

f. System Software Documentation shall include the following as a minimum:

(1) Complete hard copies of ladder diagram programming.

(2) Complete listing of external and internal I/O address assignments, register assignments, and preset constant values along with functional point descriptions. Also list unused/undefined I/O and data table registers available.

(3) Complete hard copies of program documentation for all types of programs.

(4) Detailed system memory map defining memory segments used and spare memory segments available for system memory, I/O tables, Data Tables, and control program.

(5) Complete database listing.

(6) User's manual describing procedures and providing examples for use of programming terminal, accessories, and system utility routines to perform control, program modification, program verification, diagnostics, program documentation, loading and backup, and other required system support functions.

Spare Parts; G-A0

After approval of the shop drawings, and not later than 60 days

prior to the start of operation, spare parts data for each different item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

#### SD-06 Test Reports

##### Acceptance Testing; G-AO

Test reports in booklet form showing field tests performed to adjust each component and to prove compliance with the specified performance criteria. Each test report shall indicate the final position of controls.

#### SD-10 Operation and Maintenance Data

##### Field Training; G-AO

Six complete copies of operating instructions outlining the step-by-step procedures required for system startup, operation and shutdown. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of equipment and their basic operating features. Six complete copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and trouble shooting guides. The instructions shall include simplified diagrams for the system as installed. The manual shall require valves be numbered and tagged and shall provide a schematic indicating the number of each valve. Each set shall be permanently bound and shall have a hard cover. The following identification shall be inscribed on the covers: the words "OPERATING AND MAINTENANCE INSTRUCTIONS," name and location of the facility, name of the Contractor, and contract number. These instructions shall include, but not be limited to the following:

- a. System layout showing piping, valves and controls and installation requirements.
- b. Approved wiring, logic, and control diagrams prepared in accordance with ISA S5.1 including a drawing index, legend and symbols list, and abbreviations and identifiers.
- c. A control sequence describing startup, operation, and shutdown; including the functional and operational description of the control system covering the procedures for programming, operation, startup, shut-down, and calibration.
- d. Operating and maintenance instructions for each piece of equipment, including checkout, troubleshooting, and servicing.
- e. Manufacturer's bulletins, cut sheets and descriptive data, parts list, and recommended spare parts.

## 1.4 QUALIFICATIONS

### 1.4.1 Installer

The installer shall have a minimum of 3 years experience in the installation of a minimum of 3 similar filtration systems and shall show

evidence of satisfactory operation for each installation.

#### 1.4.2 Manufacturer's Representative

A representative of the filtration system manufacturer, who is familiar with the design and experienced in the installation, adjustment, and operation of the equipment specified shall be present at the jobsite during installation of the filtration system.

#### 1.5 DELIVERY, STORAGE AND HANDLING

Equipment delivered and placed in storage shall be protected from the weather, excessive humidity, excessive temperature variation, and dirt, dust, or other contaminants.

#### 1.6 FIELD MEASUREMENTS

The Contractor shall verify all dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing the work.

### PART 2 PRODUCTS

#### 2.1 MATERIALS AND EQUIPMENT

##### 2.1.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

##### 2.1.2 Nameplates

Each major item of equipment shall have the manufacturer's name, address, type of style, model or serial number, and catalog number on a plate secured to the item of equipment.

##### 2.1.3 Protection of Moving Parts

Belts, chains, couplings, and other moving parts shall be completely enclosed by guards to prevent accidental personal injury. Guards shall be removable or arranged to allow access to the equipment for maintenance. If equipment is housed in a lockable housing, this shall be sufficient protection and no additional guards are necessary.

##### 2.1.4 Special Tools

One set of special tools, calibration devices, and instruments required for operation, calibration, and maintenance of the equipment shall be provided.

##### 2.1.5 Steel Plates, Shapes and Bars

ASTM A 36/A 36M.

##### 2.1.6 Pipe and Fittings

Pipe and fittings shall conform to the standards defined in specification

section 15200A PIPELINES, LIQUID PROCESS PIPING.

## 2.2 GENERAL REQUIREMENTS

### 2.2.1 Electrical Work

Electrical motor-driven equipment specified shall be provided complete with motors and controls. Electrical work shall be as specified in Section 16415 ELECTRICAL WORK, INTERIOR. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices, shall be provided.

### 2.2.2 Electrical Power Control

A complete electrical power, control, and instrumentation system as specified or recommended by the equipment manufacturer for the safe operation and supervision of the filter units and related equipment shall be provided, except those items specified to be furnished under other sections. Schematics and interconnection wiring diagrams for power, control, and instrumentation circuits shall be provided to equipment specified. Terminal blocks (plus 25 percent spare terminals) shall be provided in panels to terminate field and interconnection wiring. Control power transformers, relays, adjustable timers, auxiliary contacts, switches, or additional equipment as required shall be provided to interconnect the filter equipment to a remote plant monitoring system, and control circuits as shown on schematic or instrument control system drawings. Conduit wiring between control panels and control devices shall be furnished as part of this specification.

### 2.2.3 Bolts, Nuts, Anchors, and Washers

Bolts, nuts, anchors, and washers shall be steel, galvanized in accordance with ASTM A 153/A 153M.

### 2.2.4 Valves

Transfer of water to and from the filtration unit shall be accomplished by a plug valve or butterfly valve for manual operation. Design of the valve mechanisms shall be such that gradually increasing flows will be attained as ports are opened and initial surges and sudden inrushes of water are avoided. A dial pointer shall indicate each step of the operation.

### 2.2.5 Pressure Gauges

Gauge sizes and scale ranges shall be as shown or scheduled on the Contract Drawings. Gauges shall comply with ASME B40.1 Type 2A, as a minimum. Compound gauges shall be provided on the suction side of pumps and standard pressure gauge on the discharge side of pumps. Gauges shall have clear acrylic or shatterproof glass windows and shock-resistant cases. The design operations should be at the midpoint of the graduated scale. Major divisions shall be equally spaced and shall be in whole integers. Scale units shall be engraved on the scale face. Pointer travel shall not be less than 200 degrees nor more than 270 degrees arc. Gauge accuracy shall be plus or minus 0.5 percent of span. Each gauge, except those for hydraulic systems, shall have a process shutoff valve.

### 2.2.6 Gauge Panel

A control panel shall be provided on which the nominal pressure gauges for

each unit to sense unit inlet and outlet pressures and the unit pressure switches shall be mounted. A status pilot light and an alarm pilot light shall be provided for each bag filter unit. The pressure sensor switch shall be wired to a control panel which sounds an alarm and lights a pilot light when the differential pressure exceeds the maximum differential pressure specified in Paragraph Design Criteria or Cartridge and Bag Design Criteria (as applicable).

## 2.3 BAG FILTER

### 2.3.1 Equipment Capacity

The Contractor shall supply two filtration units. One unit shall be on-line, one shall be standby. Each on-line and standby unit shall have the capacity to treat the entire water stream as specified in Paragraph Bag Design Criteria.

### 2.3.2 Gasket Material

A single gasket cover seal for each bag element shall be provided. The material of construction shall be as recommended by the manufacturer.

### 2.3.3 Pore Size/Rating

The bag pore size shall be 25 microns.

### 2.3.4 Bag Support

Support material shall be per manufacturer's recommendation.

### 2.3.5 Filter Housing

#### 2.3.5.1 Material of Construction

The filter housing head, shell, and associated internal and external connections and internal and external hardware shall be constructed of 304 stainless steel or carbon steel. The housing shall be prefabricated and delivered to the site in such a condition that the unit can be fastened in the location designated on the design drawings. The filter housing shall be sized to occupy the space defined in the Contract drawings.

#### 2.3.5.2 Shell O-Ring Material

The filter housing shell O-ring material shall be per manufacturer's recommendation.

## 2.4 SAMPLE PORTS

Two sample ports, at a minimum, shall be located on each unit; one to sample the influent and one to sample the effluent. The sample ports shall be readily accessible and shall be of the manufacturer's standard design and placement.

## 2.5 DRAIN LINE

A drain line shall be located to facilitate the removal of water from the filter tank. The drain line shall be readily accessible and shall be of the manufacturer's standard design and placement.

## 2.6 SPARE PARTS

Standard spare parts shall be provided as recommended in the manufacturer's instruction manuals for each component of the equipment.

## 2.7 MATERIALS PROTECTION

The interior and exterior of fabricated ferrous metal components shall be treated after fabrication to prevent corrosion. The surfaces of the filter tanks shall be sandblasted and completely factory finish painted prior to shipment. Insulating components such as gaskets, couplings, or bushing or dielectric-type which will prevent corrosion of bimetallic-type contacts, shall be used at connections between dissimilar metals.

## PART 3 EXECUTION

### 3.1 GENERAL

#### 3.1.1 Fabrication

Work not required to be performed in the field shall be performed in a factory under controlled conditions.

#### 3.1.2 Installation

The system shall be installed such that proper water flow through the unit and required effluent conditions as specified in Paragraph Bag Design Criteria will be achieved and maintained. Electrical work shall be in accordance with the applicable requirements of Section 16415 ELECTRICAL WORK, INTERIOR.

### 3.2 PAINTING

Painting shall be performed in accordance with applicable requirements provided in Section 09900 PAINTING, GENERAL, and additional requirements provided herein.

#### 3.2.1 General

Metal surfaces, except aluminum, bronze, brass, galvanized steel, and stainless steel shall be painted. Surface preparation and painting shall be performed in the shop or in the field as indicated. Manufactured items, such as motors and switchboards, shall be finished with the manufacturer's standard finish.

#### 3.2.2 Preparation and Application

Ferrous metal surfaces shall be prepared in accordance with SSPC SP 6 and painted with two coats of epoxy paint in accordance with SSPC PS 13.01.

#### 3.2.3 Testing

Coating shall be examined for flaws and tested for thickness. Thickness of coatings shall be measured wet and dry using a commercial film thickness gauge. The Contracting Officer shall be notified in advance of any painting. Additional coats shall not be applied until the previous coat has been approved. Repair or additional coats shall be accomplished at no additional cost to the government.

### 3.2.4 Coating Repair

If welding is required after application of the coating or if the coating is damaged in any way, repair shall consist of preparing the affected area in compliance with SSPC SP 6 and reapplying the coating to that area. If holidays are detected or film thickness is insufficient, the surface shall be prepared and additional coats applied in the affected area in compliance with the manufacturer's instructions.

## 3.3 VALVE AND PIPE INSTALLATION

### 3.3.1 Valves

Valves shall be installed as nearly as possible in the position shown. Valves shall be erected and supported in their respective position free from distortion and strain on appurtenances during handling and installation. Material shall be inspected for defects in workmanship and material. Debris and foreign material shall be cleaned out of valve openings and seats; operating mechanisms shall be operated to check their proper functioning, and nuts and bolts checked for tightness. Valves and other equipment which do not operate easily or are otherwise defective shall be repaired or replaced.

### 3.3.2 Piping

Piping shall be installed to accurate lines and grades. Where temporary supports are used they shall be sufficiently rigid to prevent shifting or distortion of the pipe. Provision shall be made for expansion where necessary. Piping shall pitch toward low points, and provision shall be made for draining these low points. A sufficient number of unions or flanges shall be used to allow for the dismantling of all water pipe, valves, and equipments. Installation of piping including cleaning, cutting, threading and jointing, shall be in accordance with Section 15200A PIPELINES, LIQUID PROCESS PIPING.

## 3.4 IDENTIFICATION SYSTEMS

### 3.4.1 Identification Tags

Identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and valve number shall be installed on valves, except those valves installed on supplies at plumbing fixtures. Tags shall be 1-3/8 inch minimum diameter, and marking shall be stamped or engraved. Indentations shall be black, for reading clarity. Tags shall be attached to valves with No. 12 AWG, copper wire, chrome-plated beaded chain, or plastic straps designed for that purpose.

### 3.4.2 Color Coding

Color coding for piping identification shall be as specified in Section 09900 PAINTING, GENERAL.

## 3.5 VENT LINE INSTALLATION

The vent line shall be installed according to the manufacturer's standard design and placement. The vent line shall be located in position to reduce system operating pressure prior to replacement of filter elements.

## 3.6 POSTING FRAMED INSTRUCTIONS

Framed instructions containing wiring and control diagrams under glass or in laminated plastic shall be posted where directed. Condensed operating instructions, prepared in typed form, shall be framed as specified above and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the system.

### 3.7 FIELD TESTS AND INSPECTIONS

#### 3.7.1 General

The Contractor shall perform field tests in the presence of the Contracting Officer and shall provide labor, equipment, and incidentals required for the tests. The Contractor shall provide for disposal of all waste residuals resulting from the tests. The Contractor shall notify the Contracting Officer 7 days prior to the date and time for the acceptance tests. Any deficiencies found shall be rectified and work affected by such deficiencies shall be retested.

#### 3.7.2 Initial Operation

Following completion of installation of the treatment systems and after the Contractor and manufacturer's representative agree the system is ready for operation, the system shall be operated over an initial operating period not to exceed 14 days. The Contractor shall demonstrate proper operation of the equipment, including, but not limited to, the ability of the system to produce the minimum specified effluent requirements detailed in Paragraph Design Criteria or Cartridge and Bag Design Criteria (as applicable), proper operation of the media cleaning equipment, and the control system ability to provide the correct operational logic to optimize the filtration process.

#### 3.7.3 Acceptance Testing

Acceptance testing shall commence not sooner than 7 days and not later than 14 days following approval of the initial operation. The acceptance tests shall demonstrate the ability of the filtration system to meet the effluent specified requirements when operating at the design flow rate and to demonstrate the control system ability to provide the correct operational logic to optimize the filtration process. The tests shall be conducted over 7 days of continuous operation. Three effluent samples shall be collected during each the test period. The samples shall be analyzed for turbidity, total suspended solids and effluent particle size by standard test methods. For the filtration system to qualify for process acceptance, the average value of each of the filtered water effluent parameters monitored during the continuous testing shall not exceed the values of the specified parameters. In the event that the specified filtered water quality requirements are not met during the period that acceptance testing is conducted, the defective equipment or operation shall be modified or replaced and the testing repeated. The schedule for retesting is subject to approval by the Contracting Officer.

### 3.8 FIELD TRAINING

A field training course shall be provided for designated operating and maintenance staff members. Training shall be provided for a total period of 4 hours of normal working time and shall start after the system is functionally complete but prior to final acceptance test. Field training shall cover all of the items contained in the Operation and Maintenance

Manual.

-- End of Section --

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## SECTION 11400A

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## SECTION 11400A

## WALK-IN REFRIGERATOR EQUIPMENT

01/02

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN GAS ASSOCIATION LABORATORIES (AGAL)

## AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 420 (1995) Unit Coolers for Refrigeration

ASHRAE 15 (1994) Safety Code for Mechanical Refrigeration

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123/A 123M (2001) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 167 (1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

ASTM A 240/A 240M (2000) Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels

ASTM A 269 (2000) Seamless and Welded Austenitic Stainless Steel Tubing for General Service

ASTM A 36/A 36M (2000a) Carbon Structural Steel

ASTM B 32 (1996) Solder Metal

ASTM D 520 (2000) Zinc Dust Pigment

## AMERICAN WELDING SOCIETY (AWS)

AWS A5.8 (1992) Filler Metals for Brazing and Braze Welding

## NSF INTERNATIONAL (NSF)

NSF 2 (1996) Food Equipment

NSF 7 (1999) Commercial Refrigerators and

## Storage Freezers

## UNDERWRITERS LABORATORIES (UL)

UL 197	(1993; Rev thru Jan 2000) Commercial Electric Cooking Appliances
UL 207	(1993; Rev thru Oct 1997) Refrigerant-Containing Components and Accessories, Nonelectrical
UL 471	(1995; Rev thru Apr 1998) Commercial Refrigerators and Freezers
UL 489	(1996; Rev thru Dec 1998) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 710	(1995; Rev thru Apr 1999) Exhaust Hoods for Commercial Cooking Equipment
UL Elec Equip Dir	(1999) Electrical Appliance and Utilization Equipment Directory

## 1.2 GENERAL REQUIREMENTS

Refrigerator equipment shall be of the sizes and types shown. Equipment, materials, and fixtures required for use in conjunction with the items to be furnished and installed by the Contractor.

## 1.2.1 Mechanical, Electrical, and Plumbing Work

Plumbing systems, including final connections, shall be in accordance with Section 15400A PLUMBING, GENERAL PURPOSE. Electrical equipment, motors, wiring, and final connections shall be in accordance with Section 16415A ELECTRICAL WORK, INTERIOR. Painting shall be in accordance with Section 09900 PAINTS AND COATINGS.

## 1.2.2 Verification of Dimensions and Coordination of Project Data

The Contractor shall become familiar with all details of the work and shall advise the Contracting Officer of any discrepancy before performing any work. The Contractor shall perform the following:

- a. Horizontal and vertical dimensions shall be field verified.
- b. Contract drawings and submittal data shall be reviewed for accuracy and completeness.
- c. The installed utility capacity and location shall be field checked.
- d. Not Used.
- e. Delivery shall be coordinated for access through finished openings and vertical handling limitation within the building.

## 1.2.3 Standard Products

Materials and equipment shall be the standard products of manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. The experience used shall include applications of equipment and materials under similar circumstances and of similar size. When two or more of the same products are supplied they shall be products of one manufacturer. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

#### 1.2.4 Underwriters Laboratories Standards

Electrically operated equipment shall be in accordance with applicable UL standards such as UL 471, UL 489, UL 710 and UL 197. Evidence of meeting the requirements shall be a UL label on the equipment, a UL listing mark per UL Elec Equip Dir or a certified test report from a nationally recognized independent testing laboratory indicating that the specific food service equipment has been tested and conforms to the applicable UL standards.

#### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

##### SD-02 Shop Drawings

Walk-In Refrigeration Equipment; G-DO  
Installation; G-DO

Data consisting of a complete list of equipment and materials. Detail drawings showing complete wiring, piping, and schematic diagrams, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work, including clearances for maintenance and operation.

a. Detail drawings by Contractor shall be separate drawings and shall be the contractor's standard sheet size, but not smaller than the contract drawings. Drawings shall indicate the service equipment and assemblies with itemized schedule, and special conditions drawings indicating size, cores, wall openings, blockouts, access panels, and above ceiling hanger assemblies, rough-in plumbing/mechanical systems and rough-in electrical systems.

b. Detail drawings by manufacturer shall be separate drawings; sheet size shall be manufacturer's standard size and indicate construction details, sections, and elevations, adjacent walls, columns, and equipment, plumbing and electrical schematics, and fabricated fixtures with single electrical or plumbing connection, and service access panels required for maintenance or replacement of mechanical or electrical components.

c. Detail drawings by the Contractor that show the size, type,

and location of equipment drain lines. Drawings shall indicate drain lines from equipment, distances of drain lines and floor drain receptacles from equipment and aisles, and elevation views of drain piping.

#### SD-03 Product Data

Food Service Equipment; G-DO

Manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Brochures shall have front and rear protective covers with labeled project name and include an index indicating item number, quantity, description, and manufacturer, a fly sheet for each component indicating item number, name, quantity, manufacturer, optional equipment, modification, special instruction, and utility requirements, and catalog specifications sheets.

#### SD-06 Test Reports

Testing;

Test reports in booklet format showing all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

#### SD-10 Operation and Maintenance Data

Food Service Equipment;

Complete copies of the service manual, not later than 3 months prior to the date of beneficial occupancy, with data for each different item of material and equipment specified. Service manuals shall include:

- a. Maintenance instructions.
- b. Manufacturer's catalog specification sheets and manufacturer's detail and control drawings.
- c. Manufacturer's operation manual outlining the step-by-step procedures for equipment installation, startup, basic operation features, and operation shutdown.
- d. Manufacturer's maintenance manual listing routine maintenance procedures, possible breakdowns, repairs, and troubleshooting guides. The instructions shall include simplified diagrams for the equipment as installed.
- e. Manufacturer's list of parts and supplies with current unit price and address of manufacturer's parts supply warehouse.

### 1.4 DELIVERY AND STORAGE

#### 1.4.1 Delivery

Unless otherwise directed, the following procedures shall apply:

- a. Field assembled fixed equipment integrated into structure shall be sent to jobsite when required.
- b. Fixed equipment not integrated into structure shall be sent to the jobsite after completion of finished ceilings, lighting, and acidizing of the finished floor and wall systems, including painting.
- c. Major movable equipment shall be delivered to inventory in a secured area for interim jobsite storage, or if secured area is not available, when fixed equipment installation/clean-up has been completed.
- d. Minor appliances and loose items shall be delivered to the jobsite when the Contracting Officer is prepared to receive and inventory such items.

#### 1.4.2 Storage

Items delivered and placed into storage shall be stored with protection from weather, humidity, and temperature variation, dirt and dust, or other contaminants.

#### 1.4.3 Protection of Fixed/Fabricated Manufactured Equipment

Fiberboard or plywood shall be taped to surfaces as required by equipment shape and installation access requirements.

#### 1.4.4 Prohibited Use of Equipment

Walk-in refrigerator and equipment shall not be used as tool and material storage, work bench, scaffold, or stacking area.

#### 1.4.5 Damaged Equipment

Contractor shall immediately submit documentation to the Contracting Officer with a recommendation of action for repair or replacement and the impact on project schedule.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

The Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS. Other materials shall conform to the following:

##### 2.1.1 Stainless Steel, Nonmagnetic

ASTM A 167 or ASTM A 240/A 240M: 18-8, 300 Series, austenitic, polished to No. 3 or 4 finish on exposed surfaces.

##### 2.1.2 Stainless Steel Pipe and Tubing

ASTM A 269. Pipe and tubing shall be seamless or welded, of the gauge specified, of true roundness, and of material as specified for stainless steel. Seamless tubing shall be thoroughly annealed, pickled, and ground smooth. Welded tubing shall be thoroughly heat-treated, quenched to eliminate carbide precipitation and then drawn true to size and roundness,

and ground. Tubing shall be given a No. 3 or 4 finish when exposed to view.

### 2.1.3 Galvanizing Repair Compound

ASTM D 520, Type I pigment.

### 2.1.4 Brazing Material

AWS A5.8, class shall be as applicable.

### 2.1.5 Steel Structural Shapes for Framing

ASTM A 36/A 36M. Structural shapes shall be uniform, ductile in quality, and shall be free of hard spots, runs, checks, cracks and other surface defects. Sections shall be galvanized by the hot-dip process, conforming to ASTM A 123/A 123M.

### 2.1.6 Coatings

Coatings shall be of a durable, nontoxic, nondusting, non flaking, and mildew-resistant type, suitable for use with service equipment and in conformance with NSF 2. Application shall be in accordance with the recommendations of the manufacturer.

#### 2.1.6.1 Exterior Parts

Exterior, galvanized parts, exposed members of framework, and wrought steel pipe, where specified to be painted, shall be cleaned, and free of foreign matter before applying a rust inhibiting prime and two coats of epoxy-based paint in accordance with Section 09900 PAINTS AND COATINGS, unless otherwise specified. Color shall be selected by the Contracting Officer from manufacturer's standard colors.

#### 2.1.6.2 Solder Material

ASTM B 32, Sn96.

## 2.2 PREFABRICATED WALK-IN REFRIGERATORS

Refrigerators shall be prefabricated, commercial, walk-in type suitable for the intended use. Floor, wall, and ceiling panels shall be a 4 inch thick foamed-in-place urethane metal panel. Panel R-value shall be a minimum of R-34. Mercury shall not be used in thermometers. An exterior wall mounted thermometer shall be provide adjacent to the door. Units shall conform to UL 207, UL 471, and NSF 7 floor panel design type and size as indicated on the drawings, and the following requirements:

### 2.2.1 Miscellaneous Requirements

#### 2.2.1.1 Closure Panels

Closure panels and/or trim strips to the building walls and ceiling shall be installed with concealed attachments. Closure/trim shall be of the same material as the wall panels unless otherwise noted.

#### 2.2.1.2 Door

Door panels inner and outer skins shall be of .040 inches patterned aluminum. Doors shall be filled with insulation 4 inches thick, and one

per unit. Hardware shall be stainless steel.

#### 2.2.1.3 Strip Curtains

Transparent flexible vinyl reinforced strip curtains shall be provided which are anchored at top and able to be replaced individually. Strips shall be a minimum of 8 inches in width and .08 inches thick.

#### 2.2.1.4 Door Stops

Door stops shall be provided, where necessary, to prevent walk-in refrigerator doors from striking adjacent walls, plumbing fixtures or other service equipment when door is open.

#### 2.2.1.5 Protective Bumpers

The exterior wall sides of refrigerator that are not installed against an against cmu wall shall be equipped with protective bumpers. Bumpers shall be fabricated from either .059 inches thick galvanized steel or stainless steel channel or from solid rubber or rubber-like materials having a durometer A-hardness of 75+ 5.

#### 2.2.1.6 Gasket

Gasket material shall be either natural or synthetic rubber and conform to NSF 2. Where frames are used, the panels shall fit together with gaskets that are designed for 50 percent compression.

#### 2.2.1.7 Alarm System

An alarm system shall be provided consisting of a controller, pilot and warning lights, and audible alarm as specified by the manufacturer. The controller shall be equipped with normally-open and normally-closed contacts for remote monitoring of the temperature warning alarms and the power-off conditions. Location of the warning lights and audible alarm is shown on the drawings.

### 2.2.2 Floor

#### 2.2.2.1 Prefabricated Floor Panels

Prefabricated floor panels shall be of the same construction as wall/ceiling except with 14 gauge galvanized skin, sealed watertight. Prefabricated insulated floor panels are laid over the concrete flooring and topped with a 4 inch concrete topping to form the walk-in refrigerator finish floor, as shown on the drawings. Access to the walk-in refrigerator shall have a sloping floor ramps at the entrance door.

### 2.3 UNIT COOLERS

Unit shall be forced circulation type, factory fabricated, assembled and tested, and packaged in accordance with ARI 420. Fan shall be the propeller type. Motors shall have drip proof enclosures.

#### 2.3.1 Construction

Casing shall be Type 300 stainless steel, aluminum, mill galvanized or hot-dip galvanized steel after fabrication. Zinc-coated carbon steel shall be provided with protective coating. Coils shall have copper tubes and

aluminum fins. Drain pan shall be watertight, corrosion resistant. Drainage piping for units in spaces maintained at less than 35 degrees F shall be insulated.

#### 2.3.2 Defrosting

Unit shall be fitted with an electric heat defrosting system. Defrost system shall be controlled by demand defrost controller. Controller shall include an automatic, solid-state circuitry to initiate defrost cycle based on sensing adjustable temperature difference of air moving across coil in direct proportion to frost build-up; thermostat to terminate defrost; adjustable lockout to prevent initiation of defrost during pull-down after defrost cycle; manual override switch; and status pilot light.

#### 2.3.3 CONTROLS AND INSTRUMENTS

Refrigeration system controls, instruments and devices shall be industrial quality, and shall conform to applicable requirements of ASHRAE 15. Fluid containing surfaces shall be rated for the service and constructed of materials suitable for the fluid. Component electrical rating shall be 120 volt ac, unless otherwise indicated and shall be suitable for imposed loads.

#### 2.4 Refrigeration System Alarms

##### 2.4.1 Audible Alarm

Audible alarm shall be surface-mounted, 4 inch vibrating bell type suitable for indoor or outdoor service.

##### 2.4.2 Visual Alarm

Visual alarm shall be pilot light type. Alarm shall be 100 watt, incandescent, vapor-tight fixture with cast metal guard and red lens. Panel-mounted pilot lights shall be NEMA Class 12 oil-tight, push-to-test transformer for 6-8 Vac lamps. Lamps shall be replaceable by removal of color cap. Cap color shall be as indicated.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Equipment shall be installed at locations shown in accordance with the manufacturer's written instructions. The Contractor shall make provision for the plumbing, heating, and electrical connections and for equipment indicated as being furnished and installed by the Government.

##### 3.1.1 Equipment Connections

Equipment connections shall be complete for all utilities. Unless otherwise specified, exposed piping shall be chromium-plated copper alloy.

##### 3.1.2 Not Used.

##### 3.1.3 Not Used.

##### 3.1.4 Plumbing Work

Plumbing final connection points of equipment shall be tagged, indicating item number, name of devices or components, and type of utility (water,

gas, steam, drain). Extensions of indirect waste fitting shall be provided to open-sight hub drain, floor sink or floor drains from food service equipment.

### 3.2 CONSTRUCTION OF FABRICATED EQUIPMENT

#### 3.2.1 Grinding, Polishing, and Finishing

Exposed welded joints shall be ground smooth and finished to match the adjoining material. Wherever materials have been depressed or sunken by welding operation, such depressions shall be hammered and peened flush with the adjoining surface, and again ground to eliminate high spots. Ground surfaces shall then be polished or buffed to match adjoining surfaces. Care shall be exercised in the grinding operations to avoid excessive heating of the metal and metal discoloration. Abrasives, wheels, and belts used in grinding shall be free of iron and shall not have been used on carbon steel. In all cases, the grain of rough grinding shall be removed by several successively finer polishing operations. The texture of the final polishing operation shall be uniform, smooth, and consistent. The grain direction of horizontal stainless steel surface shall be longitudinal, including the splash back. Polishing at right angle corners shall provide a mitered appearance. Butt and contact joints shall be close fitting and not require solder as a filler. Wherever brake bends occur, the bends shall be free of open texture or orange peel appearance. Where brake work does mar the uniform appearance of the material, such marks shall be removed by grinding, polishing, and finishing. Sheared edges shall be free of burrs, projections, and fins. Where miters or bullnosed corners occur, such miters and corners shall be finished with the underage of the material and ground to a uniform condition. Overlapping of material is not acceptable. Exposed stainless steel surfaces shall have a No. 3 or 4 finish. Finishes of materials, other than stainless steel, shall be comparable in appearance to commercial mill finish. Exposed surfaces shall include:

- a. Exterior surfaces exposed to view.
- b. Interior surfaces exposed to view in doorless cabinets.
- c. Undersides of shelves shall have a ground finish of No. 90 grit or finer.

#### 3.2.2 Fastening Devices

Fastening devices shall be of the same material as the metal being joined when joint pieces are of similar metal. Fastening devices shall be stainless steel when stainless steel is joined to dissimilar metal. Stud bolts shall be a minimum of 1/4-20 stainless steel with length necessary to accept washers, and required nuts, and shall be welded 9 inches on center maximum. Exposed surfaces of equipment shall be free of bolts, screws, and rivet heads. Stainless steel stud bolts shall be used to fasten tops of counters or tables to angle framing and trim to other surfaces. Such bolts shall be of the concealed type. Threads of stud bolts which are on the inside of fixtures and are either visible or might come in contact with a wiping cloth, shall be capped with chrome plated washers, lock washers, and chromium-plated brass cap nuts. Wherever bolts are welded to the underside of trim or tops, the reverse side of the welds shall be finished uniform with the adjoining surface of the trim or the top. Dimples at these points will not be acceptable.

### 3.2.3 Welding

#### 3.2.3.1 Welding Rods

Welding shall be done with welding rods of the same composition as the sheets or parts welded.

#### 3.2.3.2 Weld Quality

Welds shall be strong and ductile. Welds shall be free of imperfections such as pits, runs, spatter, cracks, low spots, voids, and shall be finished to have the same color as the adjoining surfaces. Butt welds made by welding straps under seams, or by filling in with solder, or by grinding will not be acceptable. Welded joints shall be homogeneous with the sheet metal. Spot welding shall not be substituted for continuous welding. Joints in tops of counters, tables, drainboards, exposed shelving, and sinks shall be joined by heli-arc welding or a process other than carbon-arc welding or one that will permit carbon pick-up. Joints shall be fully welded. Counter tops shall be factory welded into lengths as long as practical in order to reduce field welded joints to a minimum. Exposed welds shall be ground smooth, flush with adjacent surface and free of burrs and sharp edges. Wherever welds occur on nonfood contact surfaces not suitable for grinding or polishing, such welds and the accompanying discoloration shall be sandblasted and coated in the factory with a nontoxic metallic-base paint. Bolts and screws shall be welded by a process that will minimize the possibility of carbide precipitation. Welds in galvanized steel made after galvanizing, and the adjacent areas where galvanizing is damaged, shall be cleaned and coated with galvanizing repair compound.

#### 3.2.4 Soldering

Soldering shall serve only as a filler to prevent leakage and shall be made with solder material. Stainless steel requiring soldering shall first be cleaned of discoloration and then have a soldering flux applied. Excess or remaining flux and catalytic material shall be removed after the soldering has been completed, and the entire soldered joint and adjacent metallic surfaces shall be cleaned with a liquid alkaline or neutralizing agent to prevent any attack on the surrounding metallic surfaces by the soldering flux.

#### 3.2.5 Brazing

Brazing shall be accomplished with brazing material. Brazing shall be used only on copper tubing to brass and bronze connection fittings.

### 3.3 TESTING

Equipment shall be inspected and tested under operating conditions after installation. If inspection or test shows defects, such defects shall be corrected, and inspection and test shall be repeated. Refrigerator tests shall include the following:

#### 3.3.1 Performance Tests

A detail written test procedure shall be submitted prior to performance of tests. The Contractor shall furnish all instruments, test equipment, and personnel required for the tests; Government will furnish the necessary water and electricity for the installed equipment. Evidence shall be

submitted that the instruments have been properly calibrated by an independent laboratory at the Contractor's expense.

### 3.3.2 Operating Tests

An operating test shall be performed on all items after complete installation and adjustment. The failed test item shall be corrected and the test shall be rerun.

### 3.3.3 Clean and Adjust

Debris resulting from this work, as the installation progresses, shall be removed from the jobsite. All food service equipment, prior to demonstration, shall be cleaned and polished, both interior/exterior. Drawer slides and casters shall be lubricated and adjusted. Pressure regulating valves, timed-delay relays, thermostatic controls, temperature sensors, and exhaust hood grilles shall be adjusted, as required, for proper operation. Faucet aerators and line strainers shall be cleaned or replaced. Damage to painted finishes shall be touched up.

### 3.3.4 Equipment Start-Up/Demonstration

The Contractor shall obtain the services of the manufacturer's representative experienced in the installation, adjustment and operation of the equipment specified. The representative shall supervise the start-up, adjustment, and testing of the equipment, prior to the demonstration. Equipment shall be carefully tested, adjusted, and regulated in accordance with the manufacturer's instructions and shall be so certified in writing. A thorough operational demonstration shall be provided of all equipment and instructions furnished for general and specific care and maintenance. Selected items of equipment and attendees shall be scheduled, with the Contracting Officer, at least 2 weeks in advance of demonstration periods.

-- End of Section --

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08/01

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SECTION 11401N

ICE MACHINE, KITCHEN AND LAUNDRY ROOM APPLIANCES

08/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 250 (1993; R 1998) Household Refrigerators and Freezers

UL 749 (1997) Household Dishwashers

UL 858 (1993; R 1999) Household Electric Ranges

UL 923 (1995; R 1998) Microwave Cooking Appliances

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-03 Product Data

Kitchen and laundry room equipment; G-DO

SD-04 Samples

Kitchen and laundry room equipment; G-DO

Three samples of each indicated appliance color. Sample size shall be minimum 2 x 2 inches.

SD-08 Manufacturer's Instructions

Kitchen and laundry room equipment; G-DO

SD-10 Operation and Maintenance Data

Kitchen and laundry room equipment, Data Package 2; G-DO

Submit operation and maintenance data in accordance with Section 01781, "Operation and Maintenance Data."

PART 2 PRODUCTS

## 2.1 KITCHEN EQUIPMENT

### 2.1.1 Materials

Except as modified herein, provide manufacturer's standard materials for kitchen equipment. Provide quantities, physical dimensions, colors, and electrical characteristics as indicated. Equipment voltage ratings shall be in accordance with the electrical drawings and panel schedules. Equipment shall be installed in accordance with Specification Section 16415A, Electrical Work, Interior.

### 2.1.2 Refrigerator

UL 250 Refrigerator shall be a side-by-side type with frostproof freezer, a minimum 24 cubic feet, automatic defrosting, two clear sliding vegetable bottom baskets, a minimum of; four adjustable shelves, two door shelves and a minimum 12 egg container in the door. Separate interior shelves, multiple door shelves, and an automatic ice maker with storage bin in the freezer shall be provided. An adjustable temperature control to maintain zero degree storage conditions. Provide four fixed rollers or adjustable leg levelers. In addition, an in-door ice and water dispensing system shall be provided on the exterior side of the door. Provide safety indicating light for power failure or temperature fluctuation and magnetic door gaskets. Provide interior light for both the refrigerator and freezer sides. Refrigerator shall be a Whirlpool, model GD2SHGXX or equal. All of the aforementioned features shall be the manufacturer's standard items furnished with the refrigerator. Refrigerator color shall be equal to Whirlpool Biscuit-on-Biscuit.

### 2.1.3 Ice Maker

UL listed and NSF approved; self-contained, air-cooled model, minimum ice cube production of 355 pounds per 24 hours, and minimum bin storage capacity of 180 pounds of ice cubes. Provide stainless steel cabinet panels, solid state automatic thickness controls, built-in self-analyzing integrated circuits, removable access panels, and bin of polyethylene foam or equivalent noncorrosive construction.

### 2.1.4 Microwave Oven with Integral Exhaust Vent

UL 923 Microwave oven shall be a built-in unit, with glass window door, a minimum 1.5 cubic foot capacity, automatic oven light, browning element, 10 power levels, automatic temperature controllers, minimum two automatic memory levels, digital time controllers, and electronic touch-control panel. Unit shall have an integral exhaust hood and grease filter with rear air discharge for connection to external exhaust duct. Integral exhaust fan shall have a minimum of two speeds. The exhaust fan shall be interlocked to an outside exhaust damper and actuator provided under Section 15951A, DIRECT DIGITAL CONTROLS FOR HVAC. Microwave unit shall be a Whirlpool, model GH8155XJ or equal. All of the aforementioned features shall be the manufacturer's standard items furnished with the microwave unit. Unit color shall be equal to Whirlpool Biscuit-on-Biscuit.

### 2.1.5 Range / Oven

UL 858 Range / Oven shall be an electric, self-cleaning oven, a minimum 3.5 cubic capacity oven, with a ceramic-glass countertop cook top surface. Oven shall have a removable glass panel window door, safety door lock

during self-cleaning cycle, broiler pan, self-locking oven racks, digital clock with one-hour timer, automatic oven light, oven "on" light, oven cycling light and tempered glass control panel. A storage drawer shall be provided at the unit base. Unit shall be a Whirlpool, model GY396LXG or equal. All of the aforementioned features shall be the manufacturer's standard items furnished with the range unit. Unit color shall be equal to Whirlpool Biscuit-on-Biscuit.

#### 2.1.6 Dishwasher

UL 749, with detergent dispenser. Provide automatic control to cycle machine through wash, rinse, dry or heat, and stop phases. Include manual setting to repeat or skip phases of cycle. Equip machine with safety switch which automatically stops spraying action when door is open. Dishwasher shall have the following features, flush panel option button selections, a minimum 12 five-piece place setting capacity, 6 cycles, adjustable racks and a high temperature rinsing cycle with a minimum 500-watt input for drying dishes. Dishwashing machine shall be a Whirlpool, model DU960PWK or equal. All of the aforementioned features shall be the manufacturer's standard items furnished with the washing machine. Color shall be equal to Whirlpool Biscuit-on-Biscuit.

#### 2.1.7 Household Garbage Disposal

Garbage disposal shall be as specified in Section 15400A, PLUMBING, GENERAL PURPOSE.

### 2.2 LAUNDRY ROOM EQUIPMENT

#### 2.2.1 Washing Machine

Washing machine shall be an electric unit with a top door loading. Washing machine shall have a minimum of the following features: multiple speed combinations, 3 temperature settings, 5 water levels, and an end-of-cycle signal. Washing machine shall be a Whirlpool, model GVW9959K (electric) or equal. All of the aforementioned features shall be the manufacturer's standard items furnished with the washing machine. Washing machine unit color shall be white.

#### 2.2.2 Electric Clothes Dryer

Clothes dryer shall be an electric unit with a front (drop hinged) door loading. Dryer unit shall have a minimum of the following features: 6 temperature settings, dryer rack, end-of-cycle signal, and an interior light. Clothes dryer shall be a Whirlpool, model GEW9868K (electric) or equal. All of the aforementioned features shall be the manufacturer's standard items furnished with the clothes dryer. Dryer unit color shall be white.

## PART 3 EXECUTION

### 3.1 INSTALLATION

NFPA 70, Section 15400A PLUMBING, GENERAL PURPOSE and Section 16415A, ELECTRICAL WORK, INTERIOR. Install equipment in accordance with manufacturers' instructions.

### 3.2 FIELD QUALITY CONTROL

Conduct inspection and testing in the presence of the Contracting Officer.

3.2.1 Field Inspection

Before and after installation, inspect each piece of equipment for compliance with specified requirements.

3.2.2 Operation Tests

Upon completion, but before final acceptance, perform operation tests on each piece of equipment to determine that components, including controls, safety devices, and attachments, operate properly and in accordance with specified requirements.

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SECTION 12490A

WINDOW TREATMENT

01/98

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## SECTION 12490A

WINDOW TREATMENT  
01/98

## PART 1 WORK DESCRIPTION

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS AA-V-00200

(Rev B) Venetian Blinds

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Approved Detail Drawings; G-AO

Drawings showing fabrication and installation details. Drawings shall show layout and locations of track, direction of draw, mounting heights, and details.

## SD-03 Product Data

Window Treatments; G-DO  
Hardware; G-DO

Manufacturer's data composed of catalog cuts, brochures, product information, and maintenance instructions.

## SD-04 Samples

Window Treatments; G-DO

Three samples of each type and color of window treatment. Blind slats or louvers shall be 6 inches in length for each color. Track shall be 6 inches in length.

## 1.3 GENERAL

Window treatment shall be provided, complete with necessary brackets, fittings, and hardware. Each window treatment type shall be a complete unit provided in accordance with paragraph WINDOW TREATMENT PLACEMENT SCHEDULE. Equipment shall be mounted and operated as specified. Windows to receive a treatment shall be completely covered. The Contractor shall

take measurements at the building and shall be responsible for the proper fitting and hanging of the equipment.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

Components shall be delivered to the jobsite in the manufacturer's original packaging with the brand or company name, item identification, and project reference clearly marked. Components shall be stored in a dry location that is adequately ventilated and free from dust, water, or other contaminants and shall have easy access for inspection and handling. Materials shall be stored flat in a clean dry area with temperature maintained above 50 degrees F.

#### 1.5 FIELD MEASUREMENTS

The Contractor shall become familiar with details of the work, verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

#### 1.6 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

### PART 2 PRODUCTS

#### 2.1 WINDOW BLINDS

Each blind, including hardware, accessory items, mounting brackets and fastenings, shall be provided as a complete unit produced by one manufacturer. All parts shall be one color and match the color of the blind slat. Steel features shall be treated for corrosion resistance.

##### 2.1.1 Horizontal Blinds

Horizontal blinds shall conform to FS AA-V-00200, Type II ( 1 inch slats), except as modified below. Blind units shall be capable of nominally 180 degree partial tilting operation and full-height raising. Blinds shall be mounted as shown on drawings. Tapes for Type I slats shall be longitudinal reinforced vinyl plastic in 1-piece turn ladder construction.

##### 2.1.1.1 Head Channel and Slats

Head channel shall be steel or aluminum nominal 0.024 for Type II. Slats shall be aluminum, not less than 0.007 inch thick, and of sufficient strength to prevent sag or bow in the finished blind. A sufficient amount of slats shall be provided to assure proper control, uniform spacing, and adequate overlap.

##### 2.1.1.2 Controls

The slats shall be tilted by a transparent tilting wand, hung vertically by its own weight, and shall swivel for easy operation. The tilter control shall be of enclosed construction. Moving parts and mechanical drive shall be made of compatible materials which do not require lubrication during normal expected life. The tilter shall tilt the slats to any desired angle and hold them at that angle so that any vibration or movement of ladders and slats will not drive the tilter and change the angle of slats. A mechanism shall be included to prevent over tightening. The wand shall be

of sufficient length to reach to within 5 feet of the floor.

#### 2.1.1.3 Intermediate Brackets

Intermediate brackets shall be provided for installation of blinds over 60 inches wide and shall be installed as recommended by the manufacturer.

#### 2.2 COLOR

Horizontal blind color shall be in accordance with Section 09915 COLOR SCHEDULE.

### PART 3 EXECUTION

#### 3.1 WINDOW TREATMENT PLACEMENT SCHEDULE

Horizontal blinds shall be provided at all exterior windows with the exception of windows in vestibules and clerestory windows in room 145 Hatchery Area and 147 Water Tank Area.

#### 3.2 INSTALLATION

Installation shall be in accordance with the approved detail drawings and manufacturer's installation instructions. Units shall be level, plumb, secure, and at proper height and location relative to window units. Window treatment shall be installed so that it does not interfere with window hardware. The Contractor shall furnish and install supplementary or miscellaneous items in total, including clips, brackets, or anchorages incidental to or necessary for a sound, secure, and complete installation. Installation shall not be initiated until completion of room painting and finishing operations. Upon completion of the installation, window treatments shall be adjusted for form and appearance, shall be in proper operating condition, and shall be free from damage or blemishes. Damaged units shall be repaired or replaced by the Contractor as directed by the Contracting Officer.

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SECTION 12690

RECESSED ENTRANCE MATS

**05/99**

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-- End of Section Table of Contents --

## SECTION 12690

RECESSED ENTRANCE MATS  
05/99

## PART 1 GENERAL

## 1.1 SUBMITTALS

All items designated with a "G", including product literature, calculations, component data, certificates, diagrams, drawings, and samples shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-03 Product Data

Finishes; G-DO.  
Accessory Items; G-DO.

Manufacturer's descriptive data and catalog cuts indicating materials of construction, and installation requirements.

## SD-02 Shop Drawings

Entrance Mats; G-DO.

Shop drawings showing layout, details, special cuts, and sections.

## SD-06 Test Reports

Entrance Mats; G-DO.

Provide data on rolling load testing.

## SD-04 Samples

Finishes; G-DO.

One typical section or piece of the product at least 6 inches by 6 inches showing proposed colors and finishes to include vinyl edging.

Submit 3 samples each of proposed carpet, aluminum finish and vinyl edging.

## 1.2 PRODUCT DELIVERY, STORAGE AND HANDLING

Deliver products in manufacturer's packing with labels intact. Store undercover and protect against damage.

## PART 2 PRODUCTS

## 2.1 MATERIALS

Recessed mounted floor mat. Entrance mats shall be a recessed mat with mounted rail type and interlocking integrated ball/socket connections between rails to facilitate roll back and cleaning. Specifications and construction shall be equal to Pawling recessed mounted model no. SSF-125 or equal. Assembly shall include mat components and aluminum frame perimeter edging in a square profile.

## 2.1.1 Entrance Mat

Recessed mounted floor mat. Mat frame and treads shall be constructed of solid aluminum, including a continuous-hinged rail. Exposed hinge rail connectors shall be extruded aluminum complete with perforations for drainage. Heavy-duty carpet tread inserts designed for heavy traffic shall be absorptive and scraping shall be 100% solution-dyed 6, 6 nylon with a 12 mil monofilament insert for extra abrasiveness. Each carpet fiber and monofilament shall be fusion-bonded to a rigid two-ply backing to prevent fraying and supplied in continuous splice-free lengths. Carpet color shall be as specified in Section 09915 Color Schedule. Aluminum finish color shall be bronze.

## 2.1.1.1 Durability Testing

The manufacturer shall provide testing results, either by in-house or national testing method which quantifies the durability of the mat. Test method shall be comparable to testing with a 300 pound rolling load.

## 2.1.2 Mat Perimeter Component- (Recessed mounted floor mat)

The entrance mat shall include a perimeter heavy-duty, square profile aluminum frame approximately, 7/16-inch in thickness. Aluminum edge width shall be a minimum of 1-inch on all sides.

## PART 3 EXECUTION

## 3.1 INSTALLATION

Contractor shall field verify measurements prior to releasing materials for fabrication by the manufacturer. A mat frame shall be used to ensure recess accuracy in size, shape and depth. Drain pit shall be formed by blocking out concrete when frames are installed. Pit shall be dampproofed after concrete has set. Frames shall be assembled on site and installed so that the upper edge will be level with finish floor surface. A cement base shall be screeded inside the mat frame area using the edge provided by the frame guide. The frame shall be anchored into the cement with anchor pins a minimum of 24 inches on center. Provide entrance mat assembly to areas and to dimensions as indicated on the drawings. Provide special cut-outs at doorway threshold areas as indicated on the drawings and as necessary to provide installation and appearance without noticeable gaps between the mat and the surrounding floor tile surfaces and door thresholds. Installation of entrance mat shall be free-lay to allow for removal and cleaning of sub-floor.

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06/01

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## SECTION 12705

## FURNITURE SYSTEMS

06/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1 (1984; R 1994) Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 423 (1999a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

ASTM C 1048 (1997b) Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass

ASTM E 84 (2000a) Surface Burning Characteristics of Building Materials

ASTM E 290 (1997a) Bend Testing of Material for Ductility

## BIFMA INTERNATIONAL (BIFMA)

BIFMA X5.5 (1989) Desk Products - Tests

BIFMA X5.6 (1993) Panel Systems - Tests

## ELECTRONIC INDUSTRIES ALLIANCE (EIA)

EIA ANSI/TIA/EIA-569-A (1998) Commercial Building Standard for Telecommunications Pathways and Spaces

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA WD 1 (1999) General Color Requirements for Wiring Devices

NEMA WD 6 (1997) Wiring Devices - Dimensional Requirements

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

NFPA 101	(2000) Life Safety Code
NFPA 255	(2000) Method of Test of Surface Burning Characteristics of Building Materials
NFPA 265	(1998) Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile Wall Coverings

UNDERWRITERS LABORATORIES (UL)

UL 723	(1996; Rev thru Dec 1998) Test for Surface Burning Characteristics of Building Materials
UL 1286	(1999) Office Furnishings

## 1.2 GENERAL

This specification establishes the minimum requirements for the acquisition and installation of a complete and usable system of workstations composed of panels, supporting components, electrical hardware, communications, special electrical features, and accessories. Workstation requirements and configurations shall be in accordance with the furniture layout and typical workstation types shown in drawings and specified herein. Components, and hardware shall be provided by a single manufacturer and shall be a standard product as shown in the most recent published price lists or amendments. Electrical components shall be products of a single manufacturer to the extent practicable (different types of components may be of different manufacturers, but all units of a given component shall be from a single source). The completed installation shall comply with NFPA 70 and NFPA 101. The Contractor shall coordinate the work of this section with that to be performed under other sections. This specification may include items which are not manufactured by the furniture manufacturer; any such items shall be furnished by the Contractor under this section.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Approved Detail Drawings; G-DO  
Installation; G-DO

Drawings showing the proposed workstation installation at a scale of 1/4 inch = 1 foot, unless otherwise specified. Drawings showing communications, electronic data processing (EDP) and local area network (LAN) wire management systems may be provided as a separate submittal from remaining workstation drawings. Drawing requirements, which are the furniture manufacturer's responsibility, shall be provided as a single submittal. Electronic drawings shall be provided to the user for future re-configuration in the software package requested by the user.

The electronic drawings shall include all modifications made during installation.

a. Overall reference drawings: Drawings showing workstation locations and overall plan view within each floor. The scale shall be 1/8 inch = 1 foot. Layouts shall reflect field verified conditions.

b. Installation drawings: Drawings showing workstations, panels, components, and plan view within each floor. Workstations shall be identified by workstation type. Scale of drawings shall be identical to Architectural plans. Installation drawings shall reflect field verified conditions.

c. Workstation elevations: Dimensioned workstation elevations showing each type of workstation with panel frame configurations and all components identified with manufacturer's catalog numbers. Elevations shall be drawn at 1/2 inch = 1 foot scale.

d. Panel drawings: Panel drawings showing panel locations and critical dimensions from finished face of walls, columns, panels, including clearances and aisle widths. Assemblies shall be keyed to a legend which shall include width, height, configuration and composition of frame covers finishes and fabrics (if different selections exist within a project), power or nonpower, connectors and wall mount hardware. Drawings shall reflect field verified conditions.

e. Electrical drawings: Drawings showing power provisions including type and location of feeder components (service entry poles, base or ceiling feeds). Wiring configuration shall be identified and a legend provided as applicable.

f. Wire management capacity drawings.

g. Communication drawings showing telephone provisions:

h. Communication drawings showing electronic data processing provisions:

i. Communication drawings showing local area network provisions:

#### SD-03 Product Data

##### Installation Instructions; G-DO

Manufacturer's product and construction specifications which provide technical data for furniture system and components specified, including task lighting and illumination performance information. Literature shall include adequate information to verify that the proposed product meets the specification.

##### Warranty; G-AO

Two copies of the warranty.

##### Workstation Components; G-DO

Complete listing of part/model numbers for all components to be furnished, including names and codes of components referenced on updated drawings.

#### SD-04 Samples

Workstations; G-DO

Four sets of the following finish samples. The Government reserves the right to reject any finish samples that do not satisfy the construction or color requirements. The Contractor shall submit additional samples as required to obtain final approval. Work shall not proceed without sample approval in writing from the Contracting Officer.

a. Panel tackboard and flipper door fabric. Minimum 6 x 6 inches with label designating the manufacturer, color, fiber content, fabric weight, fire rating, and use (panel and/or tackboard).

b. Panel, work surface, modesty panel, and component finish. Minimum 2-1/2 x 3 inches with label designating the manufacturer, material composition, thickness, color, and finish.

c. Task lights.

#### SD-06 Test Reports

Selected Components; G-DO  
Panel Acoustics; G-DO  
Fire Safety; G-DO  
Electrical System; G-DO

One complete set of test reports for the proposed system.

#### SD-07 Certificates

Workstations; G-AO

Two complete sets of certificates attesting that the proposed workstation meets specified requirements. The certificate shall be dated after the award of contract, shall name the project, and shall list specific requirements being certified.

#### SD-10 Operation and Maintenance Data

Product Assembly Manual; G-AO

Three sets of assembly manuals describing assembly and reconfiguration procedures.

Product Maintenance Manuals; G-AO  
Cleaning; G-AO

Three sets of maintenance manuals describing proper cleaning and minor repair procedures.

### 1.4 DELIVERY, STORAGE, AND HANDLING

Components shall be delivered to the jobsite in the manufacturer's original packaging with the brand, item identification, and project reference clearly marked thereon. Components shall be stored in a dry location that is adequately ventilated and free from dirt and dust, water, and other contaminants, and in a manner that permits easy access for inspection and handling.

#### 1.5 PATTERN AND COLOR

Pattern and color of finishes and fabrics for panels , components, and trim shall be in accordance with Section 09915 COLOR SCHEDULE .

#### 1.6 ALTERNATE DESIGN

Manufacturers who are unable to provide workstations that conform exactly to the furniture layouts and typical workstation types shown in the contract drawings, may submit alternate designs for consideration by the Contracting Officer. Alternate designs must meet or exceed the following criteria. Alternate designs that are submitted but do not meet these criteria will be rejected.

##### 1.6.1 Workstation Size and Configuration

The alternate design shall provide workstations and components of the same basic size and configuration shown, with only the sizes of the individual components within the workstation changed to meet the standard product of the manufacturer.

##### 1.6.2 Component Requirements

The types of components or elements utilized shall be as shown on the drawings and as specified in PART 2 PRODUCTS of this specification.

##### 1.6.3 Layout

The storage capacity, number of workstations accommodated, width of aisles, or workstation configuration shall not be reduced.

#### 1.7 WARRANTY

The Contractor shall warrant the furniture systems for a period of 10 years with the following exceptions: fabrics and other covering materials, and paper handling products shall be guaranteed for 3 years, and task lights shall be warranted for 2 years. Electromagnetic ballasts shall be warranted for 2 years. Warranties shall be signed by the authorized representative of the manufacturer. Warranties accompanied by document authenticating the signer as an authorized representative of the guarantor, shall be presented to the Contracting Officer upon the completion of the project. The Contractor shall guarantee that the workstation products and installation are free from any defects in material and workmanship from the date of delivery.

## PART 2 PRODUCTS

### 2.1 PERFORMANCE AND SAFETY REQUIREMENTS

Recyclable materials shall conform to EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS. Panels, connection system, work surfaces, pedestals, shelf units, flipper door units, lateral files,

locks, accessories, and miscellaneous hardware shall meet testing as specified. ISO 9001 certified manufacturers may perform in-house testing. Manufacturers not ISO 9001 qualified shall be required to produce testing by an independent testing laboratory. Component specific requirements are listed in appropriate paragraphs.

#### 2.1.1 Selected Components

Workstations shall conform to the requirements of BIFMA X5.5 and BIFMA X5.6 with the following exceptions: Panel supported components shall be tested and pass in accordance with the requirements of BIFMA X5.6 and representative items shall be selected for testing based on worst case situations (i.e., the deepest and widest work surface or shelf). The keyboard drawer or shelf test shall be performed applying a 50 lb load to the center of the keyboard shelf for a period of 5 minutes. Any loosening of attachments, permanent deflection or damage to the operation of the drawer or shelf will be cause for rejection.

#### 2.1.2 Panel Acoustics

Acoustical panels shall have a minimum noise reduction coefficient (NRC) of 0.65 when tested in accordance with ASTM C 423 and a minimum sound transfer coefficient (STC) of 18 when tested in accordance with ASTM E 290. The test shall be conducted on the entire assembled panel, full face area (the complete core, adhesive, decorative fabric, frame and joining components).

#### 2.1.3 Fire Safety

Components shall meet requirements for flame spread and smoke development as specified by NFPA 101 except as follows. Testing shall have been conducted in accordance with either ASTM E 84, UL 723, or NFPA 255 on the entire assembled panel and each different combination of fabric and interior construction. In addition, fabric shall meet the requirements of NFPA 265. Panel flame spread shall not exceed 25 for Class A and panel smoke development shall not exceed 450 for Class A, B and C.

#### 2.1.4 General Safety

Workstation products shall be free of rough or sharp edges. Panel supported components shall have a positive, integral locking device which secures components without the use of additional screws or clamps to prevent the components from being accidentally pulled or knocked off the panels.

#### 2.1.5 Electrical System

Task lights shall be UL approved and shall meet the requirements of NFPA 70. The electrical system shall meet the requirements of UL 1286.

### 2.2 PANEL SYSTEM

#### 2.2.1 Panel System

Accessories and appurtenances for a completely finished panel assembly shall be supplied complete with the system. The system shall be capable of structurally supporting cantilevered work surfaces, shelves, files, and other components in the configurations shown on the drawings. The panel system shall be capable of structurally supporting more than one fully loaded component per panel per side. Panels shall be either tackable or

capable of accommodating fabric covered tackboards. The panel system shall be available in a variety of nominal widths and heights as designated on the drawings. Heights shall be measured from the finished floor to the top of the panel. Powered and nonpowered panels shall be compatible in height. Panel heights shall be coordinated with the HVAC and electrical designs.

#### 2.2.2 Finishes

a. The panels shall be available in the following options: acoustical. Exposed panel trim shall have a factory baked enamel or epoxy powder finish. Filler trim shall either match the panel trim or be fabric covered to match the panel fabric. Each fabric-faced panel shall have a seamless width of fabric stretched over the entire face of the panel and the color of each fabric utilized shall be consistent throughout the installation. Curved panels may use adhesives on curved sections. The fabric shall be attached securely and continuously along the entire perimeter of the panel and shall allow for easy removal and replacement in the field (with the exception of curved panels). Fabric shall be factory installed. Panel fabric shall have a decorative weave and content shall be 100% polyester.

#### 2.2.3 Raceways

Raceways shall be an integral part of the panel. Panels, whether powered or nonpowered, shall be provided with a raceway cover. Magnet held base covers will not be accepted.

#### 2.2.4 Leveling Glides

The system shall provide precise alignment of adjacent panels and shall include leveling glides to compensate for uneven floors. On panel-to-panel products, each panel shall have 2 leveling glides. On panel-to-post products each connector shall contain a leveling glide. A minimum 3/4 inch adjustment range is required for all systems.

#### 2.2.5 Panel Connection System

The panel system shall have connectors which accommodate a variety of configurations as shown on the drawings. A straight line connection of 2 panels (180 degrees), corner connection of 2 panels (90 degrees), T connection of 3 panels (90 degrees), and cross connection of 4 panels (all 90 degrees). The connector system shall provide tight connections with continuous visual and acoustical seals. All two-way and T connections should have plastic, painted metal, or fabric finish to match system. The connector system shall allow removal of a single panel within a typical workstation configuration, without requiring disassembly of the workstation or removal of adjacent panels. The connector system shall provide for connection of panels of similar or dissimilar heights. Right angle (90 degree) connections between panels shall not interfere with the capability to hang work surfaces and other components on any adjacent panel. The connector system shall provide, as required, for the continuation of electrical and communications wiring within workstations and from workstation to workstation. Filler posts shall be level with the panel.

### 2.3 WORK SURFACES

Work surfaces shall be constructed to prevent warpage. Work surfaces shall be either fully supported from the panels or supported jointly by the

panels and supplemental legs, pedestals, or furniture end panels. Supplemental end supports shall be used only under work surfaces when the work station configuration does not permit full support by the panels. Metal support brackets shall be used to support work surfaces from the panels, provide metal-to-metal fitting to the vertical uprights of the panels, shall be vertically adjustable, and shall lock the work surfaces in place without panel modifications. Abutting work surfaces shall mate closely and be at equal heights when used in side-by-side configurations in order to provide a continuous and level work surface. Work surfaces shall either have pre-drilled holes to accommodate storage components, pedestals and additional supports, or holes shall be able to be drilled at the job site to accommodate these items. Work surfaces shall be provided in sizes and configurations shown on the drawings. Work surfaces shall be available in nominal depths of 30 inches, plus or minus 2 inches, nominal lengths from 24 to 72 inches, and a nominal thickness from 1 to 1-3/4 inches. Work surfaces shall be height adjustable in 1 to 1 1/2 inch increments from 25 to 41 inches above the finished floor. Work surfaces abutting at equal heights shall provide a continuous and level work surface. Corner work surfaces, shall be provided as shown on the drawings and shall include hardware necessary to provide firm and rigid support.

#### 2.3.1 Finishes

The work surfaces shall have a finished top surface of high pressure plastic laminate, and shall have a smoothly finished underside. The work surface shall not be affected by ordinary household solvents, acids, alcohols, or salt solutions, and shall be capable of being cleaned with ordinary household cleaning solutions. Metal support brackets shall match the color and finish of trim. Edges shall be post formed or vinyl molding.

#### 2.4 PEDESTALS

Drawer configurations and pedestal height shall be as shown on the drawings. The deepest possible pedestal shall be provided for each work surface size specified. Pedestals shall be on casters and have two box drawers and one file drawer. Top shall be finished.

##### 2.4.1 Construction

With the exception of drawer fronts, pedestals and drawers shall be of steel construction. Drawer faces shall be securely attached to the drawer front.

##### 2.4.2 Finishes

The finish of steel surfaces shall be a factory baked enamel finish or powder coated. Drawer fronts shall be either steel, plastic laminate, or molded plastic.

##### 2.4.3 Drawer Requirements

Pedestals shall be field interchangeable from left to right, and right to left, and shall retain the pedestal locking system capability. Pedestals shall be designed to protect wires from being damaged by drawer operation. Pedestals shall be work surface hung, or shall support work surfaces, or shall be free standing; as shown. Drawers shall stay securely closed when in the closed position and each drawer shall contain a safety catch to prevent accidental removal when fully open. File drawers shall have either a cradle type or full extension ball bearing suspension with hanging folder

frames or compressor dividers. File drawers shall be 12 inch high. Center pencil drawer shall be mounted under the work surface and shall contain a removable pencil tray.

## 2.5 STORAGE

Flipper door cabinets, shall be provided in the sizes and configurations shown on the drawings. Flipper door cabinets shall accommodate task lighting and shall have a depth to accommodate a standard three ring binder .

### 2.5.1 Shelf Unit Construction

The shelf pan shall be of metal construction with formed edges. Shelf supporting end panels shall be constructed of metal, high density particle board, molded phenolic resin, or molded melamine. Shelf units shall accommodate relocatable shelf dividers.

### 2.5.2 Flipper Door Unit Construction

Flipper door unit shall be of equal construction to shelf units. Units shall remain securely fastened when in the locked position. Doors shall utilize a suspension system.

### 2.5.3 Lateral File Unit Construction

Lateral files shall be of steel construction. File fronts, top and end panels shall be of equal construction to shelf units. File drawers shall have full extension ball bearing drawer slides or rack and pinion suspension. File drawers shall have hanging folder frames, compressor dividers or rails and shall be capable of hanging side-to-side or front-to-back.

### 2.5.4 Finish

Shelves and dividers and top dust cover shall have a factory baked enamel finish. Shelf supporting end panels shall have either a factory baked enamel or laminate finish. Shelf bottom shall match end panel color. Metal doors shall have an exterior finish of factory baked enamel or a factory installed fabric covering and an interior finish of factory baked enamel. Metal drawers shall have a factory baked enamel finish. Flipper door fabric shall have a decorative weave and content shall be 100% polyester.

## 2.6 ACCESSORIES

### 2.6.1 Coat Storage

One panel mounted coat hook per workstation occupant shall be provided at each workstation.

### 2.6.2 Keyboard Tray

Work surfaces shall be capable of accepting an articulating keyboard on workstations as shown on the drawings. The keyboard tray shall have the capability to be fully recessed under the work surface and extend to give the user full access to the keyboard. Side travel rotation shall be a 180-degree swing. The keyboard tray shall have tilting capability and shall contain a wrist support. It should also include a mouse pad at the same level as the keyboard, and accommodate either right or left-handed

users.

### 2.6.3 Tackboards

Tackboard fabric shall be factory installed. Fabric shall have a decorative weave and content shall be 100% polyester. Location and size shall be as shown on the drawings.

## 2.7 MISCELLANEOUS HARDWARE

Brackets, supports, hangers, clips, panel supported legs, connectors, adjustable feet, cover plates, stabilizers, and other miscellaneous hardware shall be provided.

## 2.8 LOCKS AND KEYING

Drawers, and flipper door cabinets shall have keyed locks. Field changeable lock cylinders shall be provided with a minimum of 6 different key options. Each workstation shall be individually keyed and locks within a workstation shall be keyed alike. Drawers within a pedestal shall be lockable either by a central lock that controls all pedestals under one work surface or an individual keyed lock in each pedestal. Two keys shall be provided for each lock or 2 keys per workstation when keyed alike, and 3 master keys shall be provided. Keys and lock cylinders shall be numbered for ease of replacement. Locks shall be clearly labeled with a key number, except for those manufacturers who have removal format locks.

## 2.9 ELECTRICAL

Both powered and nonpowered panels shall have base raceways capable of distributing power circuits, communication cables and data lines. Nonpowered bases shall be capable of easy field conversion to powered base without requiring the panel to be dismantled or removed from the workstation. The system shall be capable of using copper cable assemblies, wiring harnesses or electrified bus and shall meet requirements of UL 1286 and NFPA 70, Article 605. Conductors shall not be installed under this Contract. The label or listing of Underwriter's Laboratories, Inc. will be accepted as evidence that the material or equipment conforms to the applicable standards of that agency. In lieu of this label or listing, a statement from a nationally recognized, adequately equipped testing agency shall be submitted indicating that the items have been tested in accordance with required procedures of UL and that the materials and equipment comply with contract requirements.

### 2.9.1 Panel Raceways

Panels shall have hinged or removable covers that permit easy access to the raceway when required but are securely mounted and cannot be accidentally dislodged under normal conditions. The raceway shall not extend past either panel face by more than 1/2 inch. Metal or plastic covers which attach securely to the raceway shall be provided as required and shall match the finish and color of the panel trim. Raceways in full size over 24 inches powered panels shall have a minimum of 2 knockouts (doors) per side for electrical connections or outlets as indicated elsewhere. Other raceways must be flush with panel face.

### 2.9.2 Power Distribution

Power distribution shall be provided as indicated on the drawings. The

panels shall have an internal power and communications raceway and the capability of disconnecting and connecting external circuits to the electrified raceway in the panel. The communications receiving raceway shall have capacity for at least six 4-pair category 5 cables. Power and communications wiring may share a common wireway if a metal divider is included to ensure electrical isolation. Doors or access openings shall be included for entry of communications cable. The electrified power raceway shall be of the 8-wire configuration.

### 2.9.3 Wire Management

Wire management capability shall be provided at all workstations. Actual wire management capacity shall accommodate all cable types specified, including the applicable manufacturer required bending radius at corners. Raceways and interfaces to the raceways shall be designed to accommodate the bend radius as shown in EIA ANSI/TIA/EIA-569-A for Category 5e and fiber optic cables communication wiring whichever is greater. The capability may be accomplished by cable access cutouts (1 minimum per work surface), covered wire management troughs in vertical end panels, horizontal wiring troughs, internal midpanel (beltline) raceways, or rear gaps (between the back edge of the work surface and the facing support panel). Grommet kits or another suitable finish arrangement shall be provided for all cable cutouts. Accessories for an externally mounted vertical and horizontal wire management and concealment system shall be provided as recommended by the manufacturer. Horizontal wire managers shall be supplied for mounting under all work surfaces. The wire managers shall be attached either to the underside of the work surface or to the vertical panel without damaging the face. Wire managers shall be prefinished and shall secure, conceal, and accommodate outlet cords as well as electrical and communications wiring. Wire channels shall match color of panel trim, attach by means of clip-on attachment, and shall conceal wires routed vertically. Power wiring shall be separated from communication wiring by use of separate raceways or by placement of channels in joint use troughs or wireways.

### 2.9.4 Task Lighting

Task light size and placement shall be provided as indicated on the contract drawings. Such lights shall be a standard component of the manufacturer's workstation products. The ends of the task light length shall not extend beyond the edges of the overhead unit. Task lights shall have structurally sound mounting devices which will prevent accidental displacement, but will allow easy removal and replacement when necessary. Fixtures shall be UL approved for use in the configurations indicated on the drawings.

#### 2.9.4.1 Luminaire Configuration

Luminaires shall be the fluorescent type and shall have prismatic lenses, baffles, or reflector systems configured to minimize glare by shielding the lamp from the view of a seated user. Task lights for each workstation shall provide a minimum of 60 foot candles of light (horizontally measured), without veiling reflections, on the work surface directly below and a maximum of 20 inches from the fixture. All diffusers, grilles or other coverings shall be easily removable to permit cleaning and relamping.

Fixtures shall be provided with energy efficient ballasts and lamps as indicated. If the type is not identified on the plans, F32T8 lamps in 4 foot units with electronic ballasts shall be used. Each luminaire shall have an easily accessible on-off switch and one rapid-start ballast. A

variable intensity control is acceptable if the low setting is equivalent to "off" with zero energy consumption. Multiple switching is also acceptable. Ganged fixtures or shared ballasts shall not be used. Lamps and ballasts shall conform to the requirements of Section 16415 ELECTRICAL WORK, INTERIOR.

#### 2.9.4.2 Wiring

Each fixture shall have a 6 foot minimum, factory installed, heavy duty electrical cordset with a grounded plug. Direct or hard wire connections are not acceptable. Unless otherwise indicated, cords shall be concealed. Cord concealment shall be built-in within panels or shall utilize field installed, manufacturer approved accessories. Cords may be extended through dedicated channels located at any point within panels or may be placed in vertical slots or in the space between panels if held in place by retainers and concealed by a cover plate. Vertical wire managers shall be prefinished and cut to size and shall extend from the task light level down to the top of the work surface below the task light. Each manager shall be attached to a panel vertical edge or connector strip without damage to the surfaces.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

The workstations shall be installed by certified installers in accordance with manufacturer's recommended installation instructions. Workstation components shall be installed level, plumb, square, and with proper alignment with adjoining furniture. The components shall be securely interconnected and securely attached to the building where required. Three sets of special tools and equipment necessary for the relocation of panels and other components shall be furnished.

#### 3.2 CLEANING

Upon completion of installation, all products shall be cleaned and polished and the area shall be left in a clean and neat condition. Any defects in material and installation shall be repaired, and damaged products that cannot be satisfactorily repaired shall be replaced.

-- End of Section --

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## SECTION 13110A

## CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE)

11/98

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## SECTION 13110A

CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE)  
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## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM B 843 (1993; R 1998) Magnesium Alloy Anodes for Cathodic Protection
- ASTM D 1248 (1998) Polyethylene Plastics Molding and Extrusion Materials

## NACE INTERNATIONAL (NACE)

- NACE RP0169 (1996) Control of External Corrosion on Underground or Submerged Metallic Piping Systems
- NACE RP0177 (1995) Mitigation of Alternating Current and Lightning Effects on Metallic Structures and Corrosion Control Systems
- NACE RP0188 (1999) Discontinuity (Holiday) Testing of Protective Coatings
- NACE RP0190 (1995) External Protective Coatings for Joints, Fittings, and Valves on Metallic Underground or Submerged Pipelines and Piping Systems
- NACE RP0285 (1995) Corrosion Control of Underground Storage Tank Systems by Cathodic Protection

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- NEMA TC 2 (1998) Electrical Polyvinyl Chloride (PVC) Tubing (EPT) and Conduit (EPC-40 and EPC-80)

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 70 (2002) National Electrical Code

## UNDERWRITERS LABORATORIES (UL)

UL 6	(1997) Rigid Metal Conduit
UL 510	(1994; Rev thru Apr 1998) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape
UL 514A	(1996; Rev Dec 1999) Metallic Outlet Boxes

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

#### Drawings; G-DO

Six copies of detail drawings consisting of a complete list of equipment and material including manufacturer's descriptive and technical literature, catalog cuts, results of system design calculations including soil-resistivity, installation instructions and certified test data stating the maximum recommended anode current output density and the rate of gaseous production if any at that current density. Detail drawings shall contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will function properly as a unit.

#### Contractor's Modifications; G-AO

Six copies of detail drawings showing proposed changes in location, scope of performance indicating any variations from, additions to, or clarifications of contract drawings. The drawings shall show proposed changes in anode arrangement, anode size and number, anode materials and layout details, conduit size, wire size, mounting details, wiring diagram, method for electrically-isolating each pipe, and any other pertinent information to proper installation and performance of the system.

### SD-03 Product Data

#### Equipment; G-DO

Within 30 days after receipt of notice to proceed, an itemized list of equipment and materials including item number, quantity, and manufacturer of each item. The list shall be accompanied by a description of procedures for each type of testing and adjustments, including testing of coating for thickness and holidays. Installation of materials and equipment shall not commence until this submittal is approved.

#### Spare Parts; G-AO

Spare parts data for each different item of material and equipment specified, after approval of detail drawings and not later than six (6) months prior to the date of beneficial

occupancy. The data shall include a complete list of parts, special tools, and supplies, with current unit prices and source of supply. One (1) spare anode of each type shall be furnished.

#### SD-06 Test Reports

##### Tests and Measurements; G-AO

Test reports in booklet form tabulating all field tests and measurements performed, upon completion and testing of the installed system and including close interval potential survey, casing and interference tests, final system test verifying protection, insulated joint and bond tests, and holiday coating test. A certified test report showing that the connecting method has passed a 120-day laboratory test without failure at the place of connection, wherein the anode is subjected to maximum recommended current output while immersed in a three percent sodium chloride solution.

##### Contractor's Modifications; G-AO

Final report regarding Contractor's modifications. The report shall include pipe-to-soil measurements throughout the affected area, indicating that the modifications improved the overall conditions, and current measurements for anodes. The following special materials and information are required: taping materials and conductors; zinc grounding cell, installation and testing procedures, and equipment; coating material; system design calculations for anode number, life, and parameters to achieve protective potential; backfill shield material and installation details showing waterproofing; bonding and waterproofing details; insulated resistance wire; exothermic weld equipment and material.

#### SD-07 Certificates

##### Cathodic Protection System; G-DO

Proof that the materials and equipment furnished under this section conform to the specified requirements contained in the referenced standards or publications. The label or listing by the specified agency will be acceptable evidence of such compliance.

##### Services of "Corrosion Expert"; G-DO

Evidence of qualifications of the "corrosion expert."

a. The "corrosion expert's" name and qualifications shall be certified in writing to the Contracting Officer prior to the start of construction.

b. Certification shall be submitted giving the name of the firm, the number of years of experience, and a list of not less than five (5) of the firm's installations three (3) or more years old that have been tested and found satisfactory.

#### SD-10 Operation and Maintenance Data

##### Cathodic Protection System; G-AO

Before final acceptance of the cathodic protection system, six copies of operating manuals outlining the step-by-step procedures required for system startup, operation, adjustment of current flow, and shutdown. The manuals shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Six copies of maintenance manual, listing routine maintenance procedures, recommendation for maintenance testing, possible breakdowns and repairs, and troubleshooting guides. The manuals shall include single-line diagrams for the system as installed; instructions in making pipe-to-reference cell and tank-to-reference cell potential measurements and frequency of monitoring; instructions for dielectric connections, interference and sacrificial anode bonds; instructions shall include precautions to ensure safe conditions during repair of pipe or other metallic systems. The instructions shall be neatly bound between permanent covers and titled "Operating and Maintenance Instructions." These instructions shall be submitted for the Contracting Officer's approval. The instructions shall include the following:

a. As-built drawings, to scale of the entire system, showing the locations of the piping, location of all anodes and test stations, locations of all insulating joints, and structure-to-reference cell potentials as measured during the tests required by Paragraph: TESTS AND MEASUREMENTS, of this section.

b. Recommendations for maintenance testing, including instructions in making pipe-to-reference cell potential measurements and frequency of testing.

c. All maintenance and operating instructions and nameplate data shall be in English.

d. Instructions shall include precautions to insure safe conditions during repair of pipe system.

### 1.3 GENERAL REQUIREMENTS

The Contractor shall furnish and install a complete, operating, sacrificial anode cathodic protection system in complete compliance with NFPA 70, with all applicable Federal, State, and local regulations and with minimum requirements of this contract. In addition to the minimum requirements of these specifications. The services required include planning, installation, adjusting and testing of a cathodic protection system, using sacrificial anodes for cathodic protection of the Water, Fire Protection, Gas lines, their connectors and lines under the slab or floor foundation. The cathodic protection system shall include anodes, cables, connectors, corrosion protection test stations, and any other equipment required for a complete operating system providing the NACE criteria of protection as specified. Insulators are required whenever needed to insulate the pipes from any other structure. Any pipe crossing the protected pipe shall have a test station. The cathodic protection shall be provided on Water, Fire Protection, and Gas pipes.

#### 1.3.1 Services of "Corrosion Expert"

The Contractor shall obtain the services of a "corrosion expert" to supervise, inspect, and test the installation and performance of the cathodic protection system. "Corrosion expert" refers to a person, who by thorough knowledge of the physical sciences and the principles of engineering and mathematics, acquired by professional education and related practical experience, is qualified to engage in the practice of corrosion control of buried or submerged metallic surfaces. Such a person must be accredited or certified by the National Association of Corrosion Engineers (NACE) as a NACE Accredited Corrosion Specialist or a NACE certified Cathodic Protection (CP) Specialist or be a registered professional engineer who has certification or licensing that includes education and experience in corrosion control of buried or submerged metallic piping and tank systems, if such certification or licensing includes 5 years experience in corrosion control on underground metallic surfaces of the type under this contract. The "corrosion expert" shall make at least 3 visits to the project site. The first of these visits shall include obtaining soil resistivity data, acknowledging the type of pipeline coatings to be used and reporting to the Contractor the type of cathodic protection required. Once the submittals are approved and the materials delivered, the "corrosion expert" shall revisit the site to ensure the Contractor understands installation practices and laying out the components. The third visit shall involve testing the installed cathodic protection systems and training applicable personnel on proper maintenance techniques. The "corrosion expert" shall supervise installation and testing of all cathodic protection.

#### 1.3.2 Contractor's Modifications

The specified system is based on a complete system with magnesium sacrificial anodes. The Contractor may modify the cathodic protection system after review of the project, site verification, and analysis, if the proposed modifications include the anodes specified and will provide better overall system performance. The modifications shall be fully described, shall be approved by the Contracting Officer's representative, and shall meet the following criteria. The proposed system shall achieve a minimum pipe-to-soil "instant off" potential of minus 850 millivolts with reference to a saturated copper-copper sulfate reference cell on the underground components of the piping or other metallic surface. The Contractor shall take resistivity measurements of the soil in the vicinity of the pipes and ground bed sites. Based upon the measurements taken, the current and voltage shall be required to produce a minimum of minus 850 millivolts "instant off" potential between the structure being tested and the reference cell. This potential shall be obtained over 95 percent of the metallic area. The anode system shall be designed for a life of twenty-five (25) years of continuous operation.

#### 1.3.3 Isolators

Isolators are required to insulate the indicated pipes from any other structure. Isolators shall be provided with a test station as shown.

#### 1.3.4 Anode and Bond Wires

A minimum of 1 magnesium anode with an unpackaged weight of 17 pounds shall be provided uniform distance along each buried section of metallic pipe line of the nonmetallic piping systems. A minimum of 1 test station shall be used for each anode. These anodes shall be in addition to anodes for the pipe under concrete slab and casing requirements. For each cathodic system, the metallic components and structures to be protected shall be made

electrically continuous. This shall be accomplished by installing bond wires between the various structures. Bonding of existing buried structures may also be required to preclude detrimental stray current effects and safety hazards. Provisions shall be included to return stray current to its source without damaging structures intercepting the stray current. The electrical isolation of underground facilities in accordance with acceptable industry practice shall be included under this section. All tests shall be witnessed by the Contracting Officer.

#### 1.3.5 Summary of Services Required

The scope of services shall include, but shall not be limited to, the following:

- a. Close-interval potential surveys.
- b. Cathodic Protection Systems.
- c. System testing.
- d. Casing corrosion control.
- e. Interference testing.
- f. Operating and maintenance manual.
- g. Insulator testing and bonding testing.
- h. Coating and holiday testing shall be submitted within 45 days of notice to proceed.

#### 1.3.6 Metallic Pipe System

In the event pipe other than nonmetallic pipe is approved and metallic pipe is used in lieu of nonmetallic pipe, all metallic sections and components of this metallic pipe system shall be protected with cathodic protection. Detailed drawings of cathodic protection for each component shall be submitted to the Contracting Officer for approval within 45 days after date of receipt of notice to proceed, and before commencement of any work.

##### 1.3.6.1 Coatings

Coatings for metallic components shall be as required for metallic fittings. Protective covering (coating and taping) shall be completed and tested on each metallic component (such as valves, hydrants and fittings). This covering shall be as required for underground metallic pipe. Each test shall be witnessed by the Contracting Officer. Coatings shall be selected, applied, and inspected in accordance with NACE RP0190 and as specified in these specifications. The use of nonmetallic pipe does not change other requirements of the specifications. Any deviations due to the use of nonmetallic pipe shall be submitted for approval.

##### 1.3.6.2 Tracer Wire

When a nonmetallic pipe line is used to extend or add to an existing metallic line, an insulated No. 8 AWG copper wire shall be thermit-welded to the existing metallic line and run the length of the new nonmetallic line. This wire shall be used as a locator tracer wire and to maintain continuity to any future extensions of the pipe line.

### 1.3.7 Tests of Components

A minimum of four (4) tests shall be made at each metallic component in the piping system. Two (2) measurements shall be made directly over the anodes and the other two (2) tests shall be over the outer edge of the component, but at the farthest point from the anodes. Structure and pipes shall be shown with the cathodic protection equipment. All components of the cathodic protection system shall be shown on drawings, showing their relationship to the protected structure or component. A narrative shall describe how the cathodic protection system will work and provide testing at each component. Components requiring cathodic protection shall include but not be limited to the following:

- a. Pipes under the floor slab or foundations.
- b. PIV.
- c. Shutoff valves.
- d. Metallic pipe extended from above ground locations.
- e. Each connector or change-of-direction device.
- f. Any metallic pipe component or section.
- g. Backflow preventor.

### 1.3.8 Drawings

Detailed drawings shall be provided showing location of anodes, insulated fittings, test stations, permanent reference cells, and bonding. Locations shall be referenced to two (2) permanent facilities or mark points.

### 1.3.9 Electrical Potential Measurements

All potential tests shall be made at a minimum of 10 foot intervals witnessed by the Contracting Officer. Submittals shall identify test locations on separate drawing, showing all metal to be protected and all cathodic protection equipment. Test points equipment and protected metal shall be easily distinguished and identified.

### 1.3.10 Achievement of Criteria for Protection

All conductors, unless otherwise shown, shall be routed to or through the test stations. Each system provided shall achieve a minimum pipe-to-soil "instant off" potential of minus 850 millivolt potentials with reference to a saturated copper-copper-sulfate reference cell on all underground components of the piping. Based upon the measurements taken, the current and voltage of the anodes should be adjusted as required to produce a minimum of minus 850 millivolts "instant off" potential between the structure being tested and the reference cell. This potential should be obtained over 95 percent of the metallic area. This must be achieved without the "instant off" potential exceeding 1150 millivolts. Testing will be witnessed by the Contracting Officer. Additional anodes shall be provided by the Contractor if required to achieve the minus 850 millivolts "instant off". Although acceptance criteria of the cathodic protection systems are defined in NACE RP0169, for this project the "instant off" potential of minus 850 millivolts is the only acceptable criteria.

### 1.3.11 Metallic Components and Typical

a. **Metallic components:** As a minimum, each metallic component shall be protected with one (1) anode. As a minimum, the magnesium anode unpackaged weight shall be 17 pounds. The magnesium anode shall be located on the side of the metallic component and routed through a test station.

b. **Fire Hydrants:** Fire hydrant pipe components shall have a minimum of two (2) anodes. These magnesium anodes shall have an unpackaged weight of 17 pounds each.

c. **Metallic Pipe Under Concrete Slab:** Pipe under concrete slab shall have a minimum of 2 magnesium anodes. These magnesium anodes shall have an unpackaged weight of 17 pounds each. Pipe under concrete slab shall have 2 permanent reference electrodes located under the slab. One (1) permanent reference electrode shall be located where the pipe enters the concrete slab. All conductors shall be routed to a test station.

d. **Metallic Valves:** Each valve shall be protected with 1 magnesium anode. The magnesium anode shall have an unpackaged weight of 17 pounds.

e. **Metallic Pipe Component or Section:** Each section of metallic pipe shall be protected with 1 magnesium anodes. The magnesium anode shall have an unpackaged weight of 17 pounds.

f. **Metallic Connectors or Change-of-Direction Devices:** Each metallic change-of-direction device shall be protected with 1 magnesium anode. The magnesium anode shall have an unpackaged weight of 17 pounds.

### 1.3.12 Metallic Component Coating

Coatings for metallic components shall be as required for metallic fittings as indicated. This will include fire hydrants, T's, elbows, valves, etc. Coatings shall be selected, applied, and inspected in accordance with NACE RP0190 and as specified in these specifications.

## PART 2 PRODUCTS

### 2.1 MAGNESIUM ANODES

A minimum of 1 anode shall be installed on any buried metallic portion of the nonmetallic pipe system. See Paragraph METALLIC COMPONENTS AND TYPICALS for additional anodes under slab.

#### 2.1.1 Anode Composition

Anodes shall be of high-potential magnesium alloy, made of primary magnesium obtained from sea water or brine, and not made from scrap metal. Magnesium anodes shall conform to ASTM B 843 and to the following analysis (in percents) otherwise indicated:

Aluminum, max.	0.010
Manganese, max.	0.50 to 1.30
Zinc	0.05
Silicon, max.	0.05
Copper, max.	0.02
Nickel, max.	0.001
Iron, Max.	0.03

Other impurities, max. 0.05 each or 0.3 max. total  
 Magnesium Remainder

The Contractor shall furnish spectrographic analysis on samples from each heat or batch of anodes used on this project.

2.1.2 Dimensions and Weights

Dimensions and weights of anodes shall be approximately as follows:

TYPICAL MAGNESIUM ANODE SIZE

(Cross sections may be round, square, or D shaped)

NOMINAL WT. LBS.	APPROX. SIZE (IN)	NOMINAL GROSS WT lb PACKAGED IN BACKFILL	NOMINAL PACKAGE DIMENSIONS (IN)
17	4 X 4 X 17	45	7-1/2 X 24

2.1.3 Packaged Anodes

Anodes shall be provided in packaged form with the anode surrounded by specially-prepared quick-wetting backfill and contained in a water permeable cloth or paper sack. Anodes shall be centered by means of spacers in the backfill material. The backfill material shall have the following composition, unless otherwise indicated:

Material	Approximate Percent by Weight
Gypsum	75
Bentonite	20
Sodium Sulphate	5
Total	100

2.1.4 Connecting Wire

2.1.4.1 Wire Requirements

Wire shall be No. 12 AWG solid copper wire, not less than 10 feet long, unspliced, complying with NFPA 70, Type RHH insulation. Connecting wires for magnesium anodes shall be factory installed with the place or emergence from the anode in a cavity sealed flush with a dielectric sealing compound.

2.2 MISCELLANEOUS MATERIALS

2.2.1 Electrical Wire

Wire shall be No. 12 AWG stranded copper wire with NFPA 70, Type Polyethylene insulation. Polyethylene insulation shall comply with the requirements of ASTM D 1248 and shall be of the following types, classes, and grades:

High-molecular weight polyethylene shall be Type I, Class C, Grade E5.

2.2.1.1 Wire Splicing

Connecting wire splicing shall be made with copper compression connectors or exothermic welds, following instructions of the manufacturer. Single split-bolt connections shall not be used. Sheaths for encapsulating electrical wire splices to be buried underground shall fit the insulated wires entering the spliced joints and epoxy potting compound shall be as specified below.

#### 2.2.1.2 Test Wires

Test wires shall be AWG No. 12 stranded copper wire with NFPA 70, Type TW or RHW or polyethylene insulation.

#### 2.2.1.3 Resistance Wire

Resistance wire shall be AWG No. 16 or No. 22 nickel-chromium wire.

#### 2.2.2 Conduit

Rigid galvanized steel conduit and accessories shall conform to UL 6. Non metallic conduit shall conform to NEMA TC 2.

#### 2.2.3 Test Boxes and Junctions Boxes

Boxes shall be outdoor type conforming to UL 514A.

#### 2.2.4 Joint, Patch, Seal, and Repair Coating

Sealing and dielectric compound shall be a black, rubber based compound that is soft, permanently pliable, tacky, moldable, and unbacked. Compound shall be applied as recommended by the manufacturer, but not less than 1/2-inch thick. Coating compound shall be cold-applied coal-tar base mastic. Pressure-sensitive vinyl plastic electrical tape shall conform to UL 510.

#### 2.2.5 Backfill Shields

Shields shall consist of approved pipeline wrapping or fiberglass-reinforced, coal-tar impregnated tape, or plastic weld caps, specifically made for the purpose and installed in accordance with the manufacturer's recommendations. When joint bonds are required, due to the use of mechanical joints, the entire joint shall be protected by the use of a kraft paper joint cover. The joint cover shall be filled with poured-in, hot coat-tar enamel.

#### 2.2.6 Epoxy Potting Compound

Compound for encapsulating electrical wire splices to be buried underground shall be a two package system made for the purpose.

#### 2.2.7 Test Stations

Stations shall be of the flush-curb-box type and shall be the standard product of a recognized manufacturer. Test stations shall be complete with an insulated terminal block having the required number of terminals. The test station shall be provided with a lockable over and shall have an embossed legend, "C.P. Test." A minimum of one (1) test station shall be provided each component of the pipe. A minimum of six (6) terminals shall be provided in each test station. A minimum of two (2) leads are required to the metallic pipe from each test station. Other conductors shall be

provided for each anode, other foreign pipe, and reference cells as required. Test stations may be constructed of nonmetallic materials. However, if nonmetallic materials are utilized, as a minimum, the materials shall be resistant to damage from ultraviolet radiation, contain good color retention qualities, contain high strength qualities, and be resistant to accidental or vandalistic impacts that might be normally encountered in the environment for which they are to be installed. The test stations shall be listed for the particular application for which they are to be utilized.

#### 2.2.8 Joint and Continuity Bonds

Bonds shall be provided across all joints in the metallic lines, across any electrically discontinuous connections and all other pipes and structures with other than welded or threaded joints that are included in this cathodic protection system. Unless otherwise specified in the specifications, bonds between structures and across joints in pipe with other than welded or threaded joints shall be No. 8 AWG stranded copper cable with polyethylene insulation. Bonds between structures shall contain sufficient slack for any anticipated movement between structures. Bonds across pipe joints shall contain a minimum of 4 inches of slack to allow for pipe movement and soil stress. Bonds shall be attached by exothermic welding. Exothermic weld areas shall be insulated with coating compound and approved, and witnessed by the Contracting Officer. Continuity bonds shall be installed as necessary to reduce stray current interference. Additional joint bondings shall be accomplished by the Contractor where the necessity is discovered during construction or testing or where the Contracting Officer's representative directs that such bonding be done. Joint bonding shall include all associated excavation and backfilling. There shall be a minimum of two (2) continuity bonds between each structure and other than welded or threaded joints. The Contractor shall test for electrical continuity across all joints with other than welded or threaded joints and across all metallic portions or components. The Contractor shall provide bonding as required and as specified above until electrical continuity is achieved. Bonding test data shall be submitted for approval.

#### 2.2.9 Resistance Bonds

Resistance bonds should be adjusted as outlined in this specification. Alternate methods may be used if they are approved by the Contracting Officer.

#### 2.2.10 Stray Current Measurements

Stray current measurements should be performed at each test station. Stray currents resulting from lightning or overhead alternating current (AC) power transmission systems shall be mitigated in accordance with NACE RP0177.

#### 2.2.11 Electrical Isolation of Structures

As a minimum, isolating flanges or unions shall be provided at the following locations:

- a. Connection of new metallic piping or components to existing piping.
- b. Pressure piping under floor slab to a building.

Isolation shall be provided at metallic connection of all lines to existing metallic system and where connecting to a building. Additionally, isolation

shall be provided between metallic lines and foreign pipes that cross the new metallic lines within 10 feet. Isolation fittings, including isolating flanges and couplings, shall be installed aboveground or in a concrete pit.

#### 2.2.11.1 Electrically Isolating Pipe Joints

Electrically isolating pipe joints shall be of a type that is in regular factory production.

#### 2.2.11.2 Electrically Conductive Couplings

Electrically conductive couplings shall be of a type that has a published maximum electrical resistance rating given in the manufacturer's literature. Cradles and seals shall be of a type that is in regular factory production made for the purpose of electrically insulating the carrier pipe from the casing and preventing the incursion of water into the annular space.

#### 2.2.11.3 Insulating Joint Testing

A Model 601 Insulation Checker, as manufactured by "Gas Electronics", or an approved equal, shall be used for insulating joint (flange) electrical testing.

#### 2.2.12 Underground Structure Coating

This coating specification shall take precedence over any other project specification and drawing notes, whether stated or implied, and shall also apply to the pipeline or tank supplier. No variance in coating quality shall be allowed by the Contractor or Base Construction Representative without the written consent of the designer. All underground metallic pipelines and tanks to be cathodically protected shall be afforded a good quality factory-applied coating. This includes all carbon steel, cast-iron and ductile-iron pipelines or vessels. Coatings shall be selected, applied, and inspected in accordance with NACE RP0190 and as specified. If non-metallic pipelines are installed, all metallic fittings on pipe sections shall be coated in accordance with this specification section.

a. The nominal thickness of the metallic pipe joint or other component coating shall be 24 mils, plus or minus 5 percent.

b. Pipe and joint coating for factory applied or field repair material shall be applied as recommended by the manufacturer and shall be one of the following:

- (1) Continuously extruded polyethylene and adhesive coating system.
- (2) Polyvinyl chloride pressure-sensitive adhesive tape.
- (3) High density polyethylene/bituminous rubber compound tape.
- (4) Butyl rubber tape.
- (5) Coal tar epoxy.

#### 2.2.12.1 Field Joints

All field joints shall be coated with materials compatible with the pipeline coating compound. The joint coating material shall be applied to an equal thickness as the pipeline coating. Unbonded coatings shall not be used on these buried metallic components. This includes the elimination of all unbonded polymer wraps or tubes. Once the pipeline or vessel is set in

the trench, an inspection of the coating shall be conducted. This inspection shall include electrical holiday detection. Any damaged areas of the coating shall be properly repaired. The Contracting Officer shall be asked to witness inspection of the coating and testing using a holiday detector.

#### 2.2.12.2 Inspection of Pipe Coatings

Any damage to the protective covering during transit and handling shall be repaired before installation. After field coating and wrapping has been applied, the entire pipe shall be inspected by an electric holiday detector with impressed current in accordance with NACE RP0188 using a full-ring, spring-type coil electrode. The holiday detector shall be equipped with a bell, buzzer, or other type of audible signal which sounds when a holiday is detected. All holidays in the protective covering shall be repaired immediately upon detection. Occasional checks of holiday detector potential will be made by the Contracting Officer's representative to determine suitability of the detector. All labor, materials, and equipment necessary for conducting the inspection shall be furnished by the Contractor.

a. Protective covering for aboveground piping system: Finish painting shall conform to the applicable paragraph of SECTION: 09900, PAINTING, GENERAL, and as follows:

b. Ferrous surfaces: Shop-primed surfaces shall be touched-up with ferrous metal primer. Surfaces that have not been shop-primed shall be solvent-cleaned. Surfaces that contain loose rust, loose mil scale, and other foreign substances shall be mechanically-cleaned by power wire-brushing and primed with ferrous metal primer. Primed surface shall be finished with two (2) coats of exterior oil paint and vinyl paint. Coating for each entire piping service shall be an approved pipe line wrapping having a minimum coating resistance of 50,000 Ohms per square foot.

#### 2.2.13 Resistance Wire

Wire shall be No. 16 or No. 22 nickel-chromium wire with TW insulation.

#### 2.2.14 Electrical Connections

Electrical connections shall be done as follows:

a. Exothermic welds shall be "Cadweld", "Bundy", "Thermoweld" or an approved equal. Use of this material shall be in strict accordance with the manufacturer's recommendations.

b. Electrical-shielded arc welds shall be approved for use on steel pipe by shop drawing submittal action.

c. Brazing shall be as specified in Paragraph: Lead Wire Connections.

#### 2.2.15 Electrical Tape

Pressure-sensitive vinyl plastic electrical tape shall conform to UL 510.

#### 2.2.16 Permanent Reference Electrodes

Permanent reference electrodes shall be Cu-CuSO<sub>4</sub> electrodes suitable for direct burial. Electrodes shall be guaranteed by the supplier for 15 years'

service in the environment in which they shall be placed. Electrodes shall be installed directly beneath pipe, or metallic component.

#### 2.2.17 Casing

Where a pipeline is installed in a casing under a roadway, the pipeline shall be electrically insulated from the casing, and the annular space sealed and filled with an approved corrosion inhibiting product against incursion of water.

### PART 3 EXECUTION

#### 3.1 CRITERIA OF PROTECTION

Acceptance criteria for determining the adequacy of protection on a buried underground pipe or metallic component shall be in accordance with NACE RP0169, NACE RP0193, NACE RP0285 and as specified below.

##### 3.1.1 Iron and Steel

The following method (a) shall be used for testing cathodic protection voltages. If more than one method is required, method (b) shall be used.

a. A negative voltage of at least minus 850 millivolts as measured between the underground component and a saturated copper-copper sulphate reference electrode connecting the earth (electrolyte) directly over the underground component. Determination of this voltage shall be made with the cathodic protection system in operation. Voltage drops shall be considered for valid interpretation of this voltage measurement. A minimum of minus 850 millivolts "instant off" potential between the underground component being tested and the reference cell shall be achieved over 95 percent of the area of the structure. Adequate number of measurements shall be obtained over the entire structure, pipe, tank, or other metallic component to verify and record achievement of minus 850 millivolts "instant off." This potential shall be obtained over 95 percent of the total metallic area without the "instant off" potential exceeding 1200 millivolts.

b. A minimum polarization voltage shift of 100 millivolts as measured between the underground component and a saturated copper-copper sulphate reference electrode contacting the earth directly over the underground component. This polarization voltage shift shall be determined by interrupting the protective current and measuring the polarization decay. When the protective current is interrupted, an immediate voltage shift will occur. The voltage reading, after the immediate shift, shall be used as the base reading from which to measure polarization decay. Measurements achieving 100 millivolts decay shall be made over 95 percent of the metallic surface being protected.

c. For any metallic component, a minimum of four (4) measurements shall be made using subparagraph (a), above, and achieving the "instant off" potential of minus 850 millivolts. Two (2) measurements shall be made over the anodes and two (2) measurements shall be made at different locations near the component and farthest away from the anode.

##### 3.1.2 Copper Piping

For copper piping, the following criteria shall apply: A minimum of 100 millivolts of cathodic polarization between the structure surface and a stable reference electrode contacting the electrolyte. The polarization

voltage shift shall be determined as outlined for iron and steel.

### 3.2 ANODE STORAGE AND INSTALLATION

#### 3.2.1 Anode Storage

Storage area for magnesium anodes will be designated by the Contracting Officer. If anodes are not stored in a building, tarps or similar protection should be used to protect anodes from inclement weather. Packaged anodes, damaged as a result of improper handling or being exposed to rain, shall be resacked by the Contractor and the required backfill added.

#### 3.2.2 Anode Installation

Unless otherwise authorized, installation shall not proceed without the presence of the Contracting Officer. Anodes of the size specified shall be installed to the depth indicated and at the locations shown. Locations may be changed to clear obstructions with the approval of the Contracting Officer. Anodes shall be installed in sufficient number and of the required type, size, and spacing to obtain a uniform current distribution over the surface of the structure. The anode system shall be designed for a life of 25 years of continuous operation. Anodes shall be installed as indicated in a dry condition after any plastic or waterproof protective covering has been completely removed from the water permeable, permanent container housing the anode metal. The anode connecting wire shall not be used for lowering the anode into the hole. The annular space around the anode shall be backfilled with fine earth in 6 inch layers and each layer shall be hand tamped. Care must be exercised not to strike the anode or connecting wire with the tamper. Approximately 5 gallons of water shall be applied to each filled hole after anode backfilling and tamping has been completed to a point about 6 inches above the anode. After the water has been absorbed by the earth, backfilling shall be completed to the ground surface level.

##### 3.2.2.1 Single Anodes

Single anodes, spaced as indicated and shown, shall be connected through a test station to the pipeline, etc., allowing adequate slack in the connecting wire to compensate for movement during backfill operation.

##### 3.2.2.2 Welding Methods

Connections to ferrous pipe shall be made by exothermic weld methods manufactured for the type of pipe supplied. Electric arc welded connections and other types of welded connections to ferrous pipe and structures shall be approved before use.

#### 3.2.3 Anode Placement - General

Packaged anodes shall be installed completely dry, and shall be lowered into holes by rope sling or by grasping the cloth gather. The anode lead wire shall not be used in lowering the anodes. The hole shall be backfilled with fine soil in 6 inch layers and each layer shall be hand-tamped around the anode. Care must be exercised not to strike the anode or lead wire with the tamper. If immediate testing is to be performed, water shall be added only after backfilling and tamping has been completed to a point 6 inches above the anode. Approximately 2 gallons of water may be poured into the hole. After the water has been absorbed by the soil, backfilling and tamping may be completed to the top of the hole. Anodes shall be installed

as specified or shown. In the event a rock strata is encountered prior to achieving specified augered-hole depth, anodes may be installed horizontally to a depth at least as deep as the bottom of the pipe, with the approval of the Contracting Officer.

#### 3.2.4 Underground Pipeline

Anodes shall be installed at a minimum of 8 feet and a maximum of 10 feet from the line, etc., to be protected.

#### 3.2.5 Installation Details

Details shall conform to the requirements of this specification. Details shown on the drawings are indicative of the general type of material required, and are not intended to restrict selection to material of any particular manufacturer.

#### 3.2.6 Lead Wire Connections

##### 3.2.6.1 Underground Pipeline/Fittings (Metallic)

To facilitate periodic electrical measurements during the life of the sacrificial anode system and to reduce the output current of the anodes, if required, all anode lead wires shall be connected to a test station and buried a minimum of 24 inches in depth. The cable shall be No.12 AWG, stranded copper, polyethylene insulated cable. The cable shall make contact with the structure only through a test station. Resistance wire shall be installed between the cable and the pipe cable, in the test station, to reduce the current output, if required. Anode connections, except in the test station, shall be made with exothermic welding process, and shall be insulated by means of at least three (3) layers of electrical tape; and all lead wire connections shall be installed in a moistureproof splice mold kit and filled with epoxy resin. Lead wire-to-structure connections shall be accomplished by an exothermic welding process. All welds shall be in accordance with the manufacturer's recommendations. A backfill shield filled with a pipeline mastic sealant or material compatible with the coating shall be placed over the weld connection and shall be of such diameter as to cover the exposed metal adequately.

##### 3.2.6.2 Resistance Wire Splices

Resistance wire connections shall be accomplished with silver solder and the solder joints wrapped with a minimum of three (3) layers of pressure-sensitive tape. Lead wire connections shall be installed in a moistureproof splice mold kit and filled with epoxy resin.

#### 3.2.7 Location of Test Stations

Test stations shall be of the type and location shown and shall be curb box mounted. Buried insulating joints shall be provided with test wire connections brought to a test station. Unless otherwise shown, other test stations shall be located as follows:

- a. Where metallic pipe or conduit crosses any other metal pipe.
- b. At both ends of casings under roadways and railways.
- c. Where both sides of an insulating joint are not accessible above ground for testing purposes.

### 3.2.8 Underground Pipe Joint Bonds

Underground pipe having other than welded or threaded coupling joints shall be made electrically continuous by means of a bonding connection installed across the joint.

## 3.3 ELECTRICAL ISOLATION OF STRUCTURES

### 3.3.1 Isolation Joints and Fittings

Isolating fittings, including main line isolating flanges and couplings, shall be installed aboveground, or within manholes, wherever possible. Where isolating joints must be covered with soil, they shall be fitted with a paper joint cover specifically manufactured for covering the particular joint, and the space within the cover filled with hot coal-tar enamel. Isolating fittings in lines entering buildings shall be located at least 12 inches above grade of floor level, when possible. Isolating joints shall be provided with grounding cells to protect against over-voltage surges or approved surge protection devices. The cells shall provide a low resistance across isolating joint without excessive loss of cathodic current.

### 3.3.2 Gas Distribution Piping

Electrical isolation shall be provided at each building riser pipe to the pressure regulator, at all points where a short to another structure or to a foreign structure may occur, and at other locations as indicated on the drawings.

## 3.4 TRENCHING AND BACKFILLING

Trenching and backfilling shall be in accordance with Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITY SYSTEMS.

## 3.5 TESTS AND MEASUREMENTS

### 3.5.1 Baseline Potentials

Each test and measurement will be witnessed by the Contracting Officer. The Contractor shall notify the Contracting Officer a minimum of five (5) working days prior to each test. After backfill of the pipe, the static potential-to-soil of the pipe shall be measured. The locations of these measurements shall be identical to the locations specified for pipe-to-reference electrode potential measurements. The initial measurements shall be recorded.

### 3.5.2 Isolation Testing

Before the anode system is connected to the pipe test shall demonstrate that no metallic contact, or short circuit exists between the two isolated sections of the pipe. Any isolating fittings installed and found to be defective shall be reported to the Contracting Officer.

#### 3.5.2.1 Insulation Checker

A Model 601 insulation checker, as manufactured by "Gas Electronics", or an approved equal, using the continuity check circuit, shall be used for isolating joint (flange) electrical testing. Testing shall conform to the manufacturer's operating instructions. Test shall be witnessed by the

Contracting Officer. An isolating joint that is good will read full scale on the meter. If an isolating joint is shorted, the meter pointer will be deflected or near zero on the meter scale. Location of the fault shall be determined from the instructions, and the joint shall be repaired. If an isolating joint is located inside a vault, the pipe shall be sleeved with insulator when entering and leaving the vault.

### 3.5.2.2 Cathodic Protection Meter

A Model B3A2 cathodic protection meter, as manufactured by "M.C. Miller", or an approved equal, using the continuity check circuit, shall be used for isolating joint (flange) electrical testing. This test shall be performed in addition to the Model 601 insulation checker. Continuity is checked across the isolation joint after the test lead wire is shorted together and the meter adjusted to scale. A full-scale deflection indicates the system is shorted at some location. The Model 601 verifies that the particular insulation under test is good and the Model B3A2 verifies that the system is isolated. If the system is shorted, further testing shall be performed to isolate the location of the short.

### 3.5.3 Anode Output

As the anodes are connected to the pipe, current output shall be measured with an approved clamp-on milliammeter, calibrated shunt with a suitable millivoltmeter or multimeter, or a low resistance ammeter. Of the three methods, the low-resistance ammeter is the least desirable and most inaccurate. The clamp-on milliammeter is the most accurate. The valves obtained and the date, time, and location shall be recorded.

### 3.5.4 Reference Electrode Potential Measurements

Upon completion of the installation and with the entire cathodic protection system in operation, electrode potential measurements shall be made using a copper-copper sulphate reference electrode and a potentiometer-voltmeter, or a direct-current voltmeter having an internal resistance (sensitivity) of not less than 10 megohms per volt and a full scale of 10 volts. The locations of these measurements shall be identical to the locations used for baseline potentials. The values obtained and the date, time, and locations of measurements shall be recorded. No less than eight (8) measurements shall be made over any length of line or component. Additional measurements shall be made at each distribution service riser, with the reference electrode placed directly over the service line.

### 3.5.5 Location of Measurements

#### 3.5.5.1 Piping or Conduit

For coated piping or conduit, measurements shall be taken from the reference electrode located in contact with the earth, directly over the pipe. Connection to the pipe shall be made at service risers, valves, test leads, or by other means suitable for test purposes. Pipe-to-soil potential measurements shall be made at intervals not exceeding 5 feet. The Contractor may use a continuous pipe-to-soil potential profile in lieu of 5 foot interval pipe-to-soil potential measurements. Additional measurements shall be made at each distribution service riser, with the reference electrode placed directly over the service line adjacent to the riser. Potentials shall be plotted versus distance to an approved scale. Locations where potentials do not meet or exceed the criteria shall be identified and reported to the Contracting Officer's representative.

#### 3.5.5.2 Casing Tests

Before final acceptance of the installation, the electrical separation of carrier pipe from casings shall be tested and any short circuits corrected.

#### 3.5.5.3 Interference Testing

Before final acceptance of the installation, interference tests shall be made with respect to any foreign pipes in cooperation with the owner of the foreign pipes. A full report of the tests giving all details shall be made. Stray current measurements shall be performed at all isolating locations and at locations where the new pipeline crosses foreign metallic pipes. The method of measurements and locations of measurements shall be submitted for approval. As a minimum, stray current measurements shall be performed at the following locations:

- a. Connection point of new pipeline to existing pipeline.
- b. Crossing points of new pipeline with existing lines.

Results of stray current measurements shall also be submitted for approval.

#### 3.5.5.4 Holiday Test

Any damage to the protective covering during transit and handling shall be repaired before installation. After field-coating and wrapping has been applied, the entire pipe shall be inspected by an electric holiday detector with impressed current in accordance with NACE RP0188 using a full-ring, spring-type coil electrode. The holiday detector shall be equipped with a bell, buzzer, or other type of audible signal which sounds when a holiday is detected. Holidays in the protective covering shall be repaired upon detection. Occasional checks of holiday detector potential will be made by the Contracting Officer to determine suitability of the detector. Labor, materials, and equipment necessary for conducting the inspection shall be furnished by the Contractor. The coating system shall be inspected for holes, voids, cracks, and other damage during installation.

#### 3.5.5.5 Recording Measurements

All pipe-to-soil potential measurements, including initial potentials where required, shall be recorded. The Contractor shall locate, correct and report to the Contracting Officer any short circuits to foreign pipes encountered during checkout of the installed cathodic protection system. Pipe-to-soil potential measurements shall be taken on as many pipes as necessary to determine the extent of protection or to locate short-circuits.

### 3.6 CLEANUP

The Contractor shall be responsible for cleanup of the construction site. All paper bags, wire clippings, etc., shall be disposed of as directed. Paper bags, wire clippings and other waste shall not be put in bell holes or anodes excavation.

### 3.7 MISCELLANEOUS INSTALLATION AND TESTING

#### 3.7.1 Coatings

All aboveground pipeline shall be coated as indicated or as approved. The

coating shall have a minimum thickness of 7 mil. The pipeline coating shall be in accordance with all applicable Federal, State, and local regulations.

### 3.7.2 Excavation

In the event rock is encountered in providing the required depth for anodes, the Contractor shall determine an alternate approved location and, if the depth is still not provided, an alternate plan shall be submitted to the Contracting Officer. Alternate techniques and depths must be approved prior to implementation.

### 3.8 SPARE PARTS

After approval of shop drawings, and not later than three (3) months prior to the date of beneficial occupancy, the Contractor shall furnish spare parts data for each different item of material and equipment specified. The data shall include a complete list of parts, special tools, and supplies, with current unit prices and source of supply. In addition, the Contractor shall supply information for material and equipment replacement for all other components of the complete system, including anodes, cables, splice kits and connectors, corrosion test stations, and any other components not listed above.

### 3.9 SEEDING

Seeding shall be done by the Contractor, as directed, in all unsurfaced locations disturbed by this construction. In areas where grass cover exists, it is possible that sod can be carefully removed, watered, and stored during construction operations, and replaced after the operations are completed since it is estimated that no section of pipeline should remain uncovered for more than two (2) days. The use of sod in lieu of seeding shall require approval by the Contracting Officer.

### 3.10 SYSTEM TESTING

The Contractor shall submit a report including potential measurements taken at adequately-close intervals to establish that minus 850 millivolts potential, "instant-off" potential, is provided, and that the cathodic protection is not providing interference to other foreign pipes causing damage to paint or pipes. The report shall provide a narrative describing how the criteria of protection is achieved without damaging other pipe or structures in the area.

-- End of Section --

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## SECTION 13120

STANDARD METAL BUILDING SYSTEMS  
**09/98; Omaha Update 3/99**

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## ALUMINUM ASSOCIATION (AA)

- AA-01 (1997) Aluminum Standards and Data
- AA-02 (1994) Aluminum Design Manual:  
Specification & Guidelines for Aluminum  
Structures

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

- AISC FCD (1995a) Quality Certification Program  
Description
- AISC-04 (1989) Specification for Structural Steel  
Buildings - Allowable Stress Design,  
Plastic Design
- AISC Pub No. S342 L (1993) Load and Resistance Factor Design  
Specification for Structural Steel  
Buildings

## AMERICAN IRON AND STEEL INSTITUTE (AISI)

- AISI-01 (1996) Cold-Formed Steel Design Manual

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM A 463/A 463M (1996a) Steel Sheet, Aluminum-Coated by  
the Hot-Dip Process
- ASTM A 653/A 653M (1997) Steel Sheet, Zinc-Coated  
(Galvanized) or Zinc-Iron Alloy-Coated  
(Galvannealed) by the Hot-Dip Process
- ASTM A 792/A 792M (1997) Steel Sheet, 55% Aluminum-Zinc  
Alloy-Coated by the Hot-Dip Process
- ASTM B 117 (1997) Operating Salt Spray (Fog) Apparatus
- ASTM B 209 (1996) Aluminum and Aluminum-Alloy Sheet  
and Plate
- ASTM D 522 (1993a) Mandrel Bend Test of Attached  
Organic Coatings

ASTM D 714	(1987; R 1994) Evaluating Degree of Blistering of Paints
ASTM D 968	(1993) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D 1308	(1987; R 1993) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D 1654	(1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 2244	(1993) Calculation of Color Differences from Instrumentally Measured Color Coordinates
ASTM D 2247	(1994) Testing Water Resistance of Coatings in 100 % Relative Humidity
ASTM D 2794	(1993) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D 3359	(1995a) Measuring Adhesion by Tape Test
ASTM D 4214	(1997) Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D 4587	s(1991) Conducting Tests on Paint and Related Coatings and Materials Using a Fluorescent UV-Condensation Light - and Water-Exposure Apparatus
ASTM E 84	(1996a) Surface Burning Characteristics of Building Materials
AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)	
ASCE 7	(1995) Minimum Design Loads for Buildings and Other Structures
AMERICAN WELDING SOCIETY (AWS)	
AWS D1.1	(1996) Structural Welding Code - Steel
SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)	
SMACNA-02	(1993; Errata) Architectural Sheet Metal Manual

## 1.2 GENERAL REQUIREMENTS

The metal building systems covered under this specification shall be provided by a single manufacturer. Structural Standing Seam Metal Roofing System is specified in SECTION: 07416 Structural Standing Seam Metal Roof (SSMR) System.

### 1.2.1 Building Configuration

Building configuration shall be as shown on the drawings and shall have structural steel main building frames, and secondary framing including purlins and girts. Framing members shall be in accordance with the design as shown on the drawings, as specified, and in accordance with the designed wind loads.

### 1.2.2 Qualifications

#### 1.2.2.1 Manufacturer

Metal building systems shall be the product of a recognized steel building systems manufacturer who has been in the practice of manufacturing steel building systems for a period of not less than 5 years. The manufacturer shall be chiefly engaged in the practice of designing and fabricating steel building systems. The manufacturer shall be certified under the Metal Building Systems (MB) Certification Program, AISC FCD.

#### 1.2.2.2 Installer

Installers shall have specialized experience in the erection of steel building systems for a period of at least 3 years.

## 1.3 DESIGN REQUIREMENTS

Criteria, loading combinations, and definitions shall be in accordance with ASCE 7.

### 1.3.1 Wind Loads

Wind pressures shall be as shown on the drawings. Load combinations shall be computed in accordance with ASCE 7.

### 1.3.2 Framing and Structural Members

Connections shall be designed in accordance with AISC-04 or AISC Pub No. S342 L. Structural cold-formed steel framing members and their connections shall be designed in accordance with AISI-01. Aluminum structural members and their connections shall be designed in accordance with AA-02. Maximum deflection under applied live load, snow, or wind load shall not exceed 1/180th of the span length. Members with openings in their webs shall be designed with consideration of the additional stresses which will result due to the openings.

### 1.3.3 Siding

Except as otherwise specified, steel siding shall be designed in accordance with AISI-01. Aluminum siding shall be designed in accordance with AA-01. Section modulus and moment of inertia of aluminum sheet shall be determined for actual cross section dimensions by the conventional methods for actual design stresses and by effective width concept for deflection in accordance with AA-02. Maximum deflection for wall panels under applied live load, snow or wind loads shall not exceed 1/180th of the span length. Maximum deflections shall be based on sheets continuous across two or more supports with sheets unfastened and fully free to deflect. The calculated deflection from the concentrated load shall not exceed 1/180 of the span length. The methods for resisting lateral loads shall be cross-bracing,

rigid frames, or wind columns.

#### 1.3.4 Provisions for Gutters And Downspouts

Gutters and downspouts shall be designed according to the requirements of SMACNA-02 for storms which should be exceeded only once in 5 years and with adequate provisions for thermal expansion and contraction. Supports for gutters and downspouts shall be designed for the anticipated loads. Roof drainage system to withstand rainfall intensity of 4 inches per hour, with 5 minute duration.

#### 1.3.5 Provisions for Louvers

Louvers shall be fixed-blade type designed for a minimum net open area as shown on the drawings, to be rainproof, and to resist vibration when air is passed at the rate of 1500 cubic feet per minute.

### 1.4 DESIGN ANALYSIS

The design analysis shall be the design of a licensed Professional Engineer experienced in design of this work and shall include complete calculations for the building, its components, and the foundations. Formulas and references shall be identified. Wind forces on various parts of the structure, both positive and negative pressure, shall be calculated with the controlling pressure summarized. Computer programmed designs shall be accompanied by stress values and a letter of certification, signed by a licensed Professional Engineer, stating the design criteria and procedures used and attesting to the adequacy and accuracy of the design. A narrative of the computer program delineating the basic methodology shall be included. Computer program output shall be annotated and supplemented with sketches to verify the input and output. Critical load conditions used in the final sizing of the members shall be emphasized. The design analysis shall include the name and office phone number of the designer, who shall function as a point of contact to answer questions during the detail drawing review.

### 1.5 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Metal Building Systems; G-DO

Detail drawings consisting of catalog cuts, design and installation drawings.  
Shop painting and finishing specifications.

SD-04 Samples

Accessories; G-DO

One sample of each type of flashing, trim, closure, cap and similar items.  
Size shall be sufficient to show construction and configuration.

Siding; G-DO

One piece of each type and finish (exterior and interior) to be used, 9 inches long, full width. The sample for factory color finished covering shall be accompanied by certified laboratory test reports showing that the sheets to be furnished are produced under a continuing quality control program and that a representative sample consisting of not less than 5 pieces has been tested and has met the quality standards specified for factory color finish.

Fasteners; G-DO

Two samples of each type to be used, with statement regarding intended use.

If so requested, random samples of bolts, nuts, and washers as delivered to the job site shall be taken in the presence of the Contracting Officer and provided to the Contracting Officer for testing to establish compliance with specified requirements.

Insulation; G-DO

One piece of each type to be used, and descriptive data covering installation.

#### SD-05 Design Data

Design Analysis; G-DO

Design analysis (building and foundations including anchor bolt plans) as one package with the drawings.

Instruction Manuals; G-DO

Manufacturer's literature for individual building component systems.

#### SD-07 Certificates

Metal Building Systems;

a. Warranty certificate. At the completion of the project the Contractor shall furnish signed copies of the 5-year Warranty for Metal Building System, a sample copy of which is attached to this section, the 20-year Manufacturer's Material Warranties, and the Manufacturer's 20-year System Weathertightness Warranty when one is required.

Insulation;

Certificate attesting that the polyisocyanurate insulation furnished for the project contains recovered material, and showing an estimated percent of such recovered material.

### 1.6 DELIVERY AND STORAGE

Materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Materials shall be covered with weathertight coverings and kept dry. Storage accommodations for siding shall provide good air circulation and protection from surface staining.

### 1.7 WARRANTIES

The Metal Building Systems, composed of siding, gutters and downspouts, accessories, fasteners, trim, and miscellaneous building closure items

shall be warranted as described below against material and workmanship deficiencies, system deterioration caused by exposure to the elements and service design loads, leaks and wind damage. Any emergency temporary repairs conducted by the owner shall not negate the warranties.

#### 1.7.1 Prime Contractor's Weathertightness Warranty

The Metal Building Systems shall be warranted by the Contractor on a no penal sum basis for a period of five years against materials and workmanship deficiencies; system deterioration caused by exposure to the elements and/or inadequate resistance to specified service design loads, water leaks, and wind uplift damage. The Metal Building System covered under this warranty shall include but is not limited to the following: siding panels and seams, exterior gutters and downspouts, accessories, fasteners, trim, flashings and miscellaneous building closure items, connectors, components, and fasteners, and other system components and assemblies installed to provide a weathertight system; and items specified in other sections of these specifications that become part of the metal building system. All metal trim and flashing items specified in this section, which are directly related to the weathertightness of the SSSMR, shall be required to comply with the warranty requirements as specified in SECTION: 07416A STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM. All material and workmanship deficiencies, system deterioration caused by exposure to the elements and/or inadequate resistance to specified service design loads, water leaks and wind damage shall be repaired as approved by the Contracting Officer. See the attached Contractor's written warranty for issue resolution of warrantable defects. This warranty shall warrant and cover the entire cost of repair or replacement, including all material, labor, and related markups. The Contractor shall supplement this warranty with written warranties from the installer and/or system manufacturer, which shall be submitted along with Contractor's warranty. However, the Contractor is ultimately responsible for this warranty. The Contractor's written warranty shall be as outlined in attached **WARRANTY FOR METAL BUILDING SYSTEMS**, and start upon final acceptance of the facility. The Contractor shall provide a separate bond in an amount equal to the installed total metal building system cost in favor of the owner (Government) covering the Contractor's warranty responsibilities effective throughout the five year Contractor's warranty period for the entire metal building systems as outlined above.

#### 1.7.2 Manufacturer's Material and/or System Weathertightness Warranties

The Contractor shall furnish, in writing, the following manufacturer's material warranties to the Contracting Officer which cover all Metal Building System components:

a. A manufacturer's 20 year material warranty warranting that the specified aluminum, zinc-coated steel, aluminum-zinc alloy coated steel or aluminum-coated steel will not rupture, structurally fail, fracture, deteriorate, or become perforated under normal design atmospheric conditions and service design loads. Liability under this warranty shall be limited exclusively to the cost of either repairing or replacing nonconforming, ruptured, perforated, or structurally failed securement system including fasteners and coil material.

b. A manufacturer's 20 year exterior material finish warranty on the factory colored finish warranting that the finish, under normal atmospheric conditions at the site, will not crack, peel, or delaminate; chalk in excess of a numerical rating of eight, as determined by ASTM D 4214 test

procedures; or change colors in excess of five CIE or Hunter Lab color difference ( $\Delta E$ ) units in accordance with ASTM D 2244. Liability under this warranty is exclusively limited to replacing the defective coated material.

#### 1.8 COORDINATION MEETING

A coordination meeting shall be held within 45 days after contract award for mutual understanding of the metal building system contract requirements. This meeting shall take place at the building site and shall include representatives from the Contractor, the roofing/metal building system manufacturer, the roofing/metal building supplier, the erector, the designer, and the Contracting Officer. All items required by paragraph SUBMITTALS shall be discussed, including applicable standard manufacturer shop drawings, and the approval process. The Contractor shall coordinate time and arrangements for the meeting.

### PART 2 PRODUCTS

#### 2.1 BUILDING COMPONENTS

Each piece or part of the assembly shall be clearly and legibly marked to correspond with the drawings.

#### 2.2 SIDING

Siding shall be either steel or aluminum and shall have a factory color finish.

##### 2.2.1 Siding

Metal panels shall be a polyurethane foam core sandwich panel. Panel composition shall consist of a minimum 24 gauge exterior panel with a stucco embossed (Azteco) finish, a 3 inch foamed-in-place polyurethane insulation core, and a minimum 26 gauge interior flat finish panel. Length of panel sheets shall be sufficient to cover the entire height of any unbroken height of wall surface unless otherwise approved. Width of panel sheets with interlocking ribs shall provide not less than 12 inches of coverage in place. Provisions shall be made for thermal expansion and contraction consistent with the type of panel system to be used. Vertical panel reveals shall be an intergal part of the panel with an interlocking tongue and groove connection with concealed fastening. Panel joints have a dry joint appearance, which allows for thermal expansion, and prevents air and moisture transfer from the exterior to the interior of the facility. Typical panel joint details are provided on the the drawings.

Siding shall have concealed interlocking ribs for securing adjacent sheets.

Exterior siding shall be fastened to framework using concealed fasteners. Interior siding shall be fastened to the framework girts using standard concealed and exposed fasteners as recommended by the panel manufacturer. Manufacturer's standard metal trim shall be provided at all convex and concave corner edges. Siding trim shall be an integral part of the siding with concealed fasteners and hemmed edges.

##### 2.2.2 Steel Panels

Siding shall be zinc-coated steel conforming to ASTM A 653/A 653M, G 90 coating designation; aluminum-zinc alloy coated steel conforming to ASTM A 792/A 792M, AZ 50 coating; or aluminum-coated steel conforming to ASTM A

463/A 463M, Type 2, coating designation T2 E5. Panels shall be 0.024 inch thick minimum.

### 2.2.3 Aluminum Panels

Siding shall be aluminum alloy conforming to ASTM B 209, temper as required for the forming operation, minimum 0.032 inch thick.

### 2.2.4 Factory Insulated Panels

Insulated wall panels shall be factory-fabricated units with insulating core between metal face sheets, securely fastened together and uniformly separated with rigid spacers, facing of steel or aluminum of composition and gauge specified for covering, constructed in a manner that will eliminate condensation on interior of panel. Panels shall have a factory color finish. Insulation shall be compatible with adjoining materials; non running and non settling; capable of retaining its R-value for the life of the metal facing sheets; and unaffected by extremes of temperature and humidity. Panels shall provide a minimum R-value of 25 for the 3 inch thick panels and a minimum R-value of 17 for the 2 inch thick panel when tested in accordance with ASTM C 236. The assembly shall have a flame spread rating not higher than 25, and smoke developed rating not higher than 450 when tested in accordance with ASTM E 84. The insulation shall remain odorless, free from mold, and shall not become a source of food and shelter for insects.

### 2.2.5 Factory Color Finish

Panels shall have a factory applied polyvinylidene fluoride finish on the exposed side. The exterior finish shall consist of a baked-on topcoat with an appropriate prime coat. Color shall match the color indicated in Section 09915 COLOR SCHEDULE. The exterior coating shall be a nominal 1 mil thickness consisting of a topcoat of not less than 0.7 mil dry film thickness and the paint manufacturer's recommended primer of not less than 0.2 mil thickness. The interior color finish shall consist of the same coating and dry film thickness as the exterior finish. The exterior color finish shall meet the test requirements specified below.

#### 2.2.5.1 Salt Spray Test

A sample of the sheets shall withstand a salt spray test for a minimum of 1000 hours in accordance with ASTM B 117, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating of not less than 8F, few No. 8 blisters, as determined by ASTM D 714; and a rating of 6, 1/8 inch failure at scribe, as determined by ASTM D 1654.

#### 2.2.5.2 Formability Test

When subjected to testing in accordance with ASTM D 522 Method B, 1/8 inch diameter mandrel, the coating film shall show no evidence of cracking to the naked eye.

#### 2.2.5.3 Accelerated Weathering, Chalking Resistance and Color Change

A sample of the sheets shall be tested in accordance with ASTM D 4587, test condition B. The coating shall withstand the weathering test without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating that can be readily

removed from the base metal with tape in accordance with ASTM D 3359, Test Method B, shall be considered as an area indicating loss of adhesion. Following the accelerated weathering test, the coating shall have a chalk rating not less than No. 8 in accordance with ASTM D 4214 test procedures, and the color change shall not exceed 5 CIE or Hunter Lab color difference ( $\Delta E$ ) units in accordance with ASTM D 2244. For sheets required to have a low gloss finish, the chalk rating shall be not less than No. 6 and the color difference shall be not greater than 7 units.

#### 2.2.5.4 Humidity Test

When subjected to a humidity cabinet test in accordance with ASTM D 2247 for 1000 hours, a scored panel shall show no signs of blistering, cracking, creepage or corrosion.

#### 2.2.5.5 Impact Resistance

Factory-painted sheet shall withstand direct and reverse impact in accordance with ASTM D 2794 0.500 inch diameter hemispherical head indenter, equal to 1.5 times the metal thickness in mils, expressed in inch-pounds, with no loss of adhesion.

#### 2.2.5.6 Abrasion Resistance Test

When subjected to the falling sand test in accordance with ASTM D 968, Method A, the coating system shall withstand a minimum of 50 liters of sand before the appearance of the base metal. The term "appearance of base metal" refers to the metallic coating on steel or the aluminum base metal.

#### 2.2.5.7 Pollution Resistance

Coating shall show no visual effects when covered spot tested in a 10 percent hydrochloric acid solution for 24 hours in accordance with ASTM D 1308.

#### 2.2.6 Accessories

Flashing, trim, metal closure strips and curbs, fascia, caps, diverters, and similar metal accessories shall be the manufacturer's standard products. Exposed metal accessories shall be finished to match the building finish. Molded closure strips shall be bituminous-saturated fiber, closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the roofing or siding and shall not absorb or retain water.

#### 2.3 FASTENERS

Fasteners for steel wall panels shall be zinc-coated steel, aluminum, corrosion resisting steel, or nylon capped steel, type and size specified below or as otherwise approved for the applicable requirements. Fasteners for aluminum wall panels shall be aluminum or corrosion resisting steel. Fasteners for attaching wall panels to supports shall provide both tensile and shear strength of not less than 750 lbs per fastener. Fasteners for accessories shall be the manufacturer's standard. Exposed wall fasteners shall be color finished or provided with plastic color caps to match the covering. Non penetrating fastener system for wall panels using concealed clips shall be manufacturer's standard for the system provided.

##### 2.3.1 Screws

Screws shall be as recommended by the manufacturer to meet the design strength requirements.

#### 2.3.2 End-Welded Studs

Automatic end-welded studs shall be shouldered type with a shank diameter of not less than 3/16 inch and cap or nut for holding covering against the shoulder.

#### 2.3.3 Explosive Actuated Fasteners

Fasteners for use with explosive actuated tools shall have a shank of not less than 0.145 inch with a shank length of not less than 1/2 inch for fastening panels to steel and not less than 1 inch for fastening panels to concrete.

#### 2.3.4 Blind Rivets

Blind rivets shall be aluminum with 3/16 inch nominal diameter shank or stainless steel with 1/8 inch nominal diameter shank. Rivets shall be threaded stem type if used for other than the fastening of trim. Rivets with hollow stems shall have closed ends.

#### 2.3.5 Bolts

Bolts shall be not less than 1/4 inch diameter, shouldered or plain shank as required, with proper nuts.

### 2.4 GUTTERS AND DOWNSPOUTS

Gutters and downspouts shall be fabricated of aluminum, zinc-coated steel or aluminum-zinc alloy coated steel and shall have manufacturer's factory color finish. Minimum uncoated thickness of materials shall be 0.018 inch for steel and 0.032 inch for aluminum. All accessories necessary for the complete installation of the gutters and downspouts shall be furnished. Accessories shall include gutter straps, downspout elbows, downspout straps and fasteners fabricated from metal compatible with the gutters and downspouts. Downspouts shall be an open-faced type as shown on the drawings.

### 2.5 LOUVERS

Louvers shall be fabricated of aluminum, zinc-coated steel, or aluminum-zinc alloy coated steel; shall have manufacturer's factory color finish; and shall be furnished with bird screens. Minimum uncoated thickness of materials shall be 0.048 inch for steel and 0.064 inch for aluminum. Manually operated louvers shall be designed to be opened and closed from the operating floor.

### 2.6 SEALANT

Sealant shall be an elastomeric type containing no oil or asphalt. Exposed sealant shall be clear and shall cure to a rubber like consistency.

### 2.7 GASKETS AND INSULATING COMPOUNDS

Gaskets and insulating compounds shall be nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds

shall be non running after drying.

## 2.8 SOFFIT PANELS, FASCIA and TRIM

Exterior soffits shall consist of 0.32 ga. aluminium or 0.024 ga. steel panels as follows:

Panel Length: as shown on the drawings,  
 Panel Width: as standard with manufacturer, however, not greater than 1'-0",  
 Panel Depth: 1 inch minimum,  
 Finish: factory applied, manufacturer's standard fluoropolymer (Knyar) or siliconized polyester coating; color as specified in SECTION 09915,  
 Appearance: panels shall have a rigid embossed texture to provide an overall flat appearance (no vents), panel shall have reveals (grooves) at a minimum 4" distance,  
 Connections: panels shall have concealed fasteners and be self-venting.

Gable and eave trim, ridge caps, fascia closure strips, and rake flashing shall be a minimum 0.032 ga. aluminium or 0.024 ga. steel (uncoated). Systems shall be as follows:

Panel Length: as shown on the drawings,  
 Panel Width: as standard with manufacturer, however, shall use one piece systems when possible,  
 Finish: factory applied, manufacturer's standard fluoropolymer (Knyar) or siliconized polyester coating; color as specified in SECTION 09915,  
 Appearance: panels shall have a smooth (non-embossed) texture,  
 Connections: trim panels shall have concealed fasteners and overlaps with sealant and gasketing fittings.

## PART 3 EXECUTION

### 3.1 ERECTION

Dissimilar materials which are not compatible when contacting each other shall be insulated from each other by means of gaskets or insulating compounds. Improper or mislocated drill holes in panels shall be plugged with an oversize screw fastener and gasketed washer; however, panels with an excess of such holes or with such holes in critical locations shall not be used. Exposed surfaces shall be kept clean and free from sealant, metal cuttings, excess material from thermal cutting, and other foreign materials. Exposed surfaces which have been thermally cut shall be finished smooth within a tolerance of 1/8 inch. Stained, discolored or damaged sheets shall be removed from the site. Welding of steel shall conform to AWS D1.1; welding of aluminum shall conform to AA-02.

#### 3.1.1 Siding Installation

Siding shall be applied with the longitudinal configurations in the vertical position. Accessories shall be fastened into framing members, except as otherwise approved. Closure strips shall be provided as indicated and where necessary to provide weathertight construction. Fastener and fastener spacing shall be in accordance with manufacture design. Panel installation shall not exceed .01 cfm per sq. ft. of wall area when tested in accordance with ASTM E-283-73 at a pressure differential of 20.0 psf. In addition, there shall be no uncontrolled

water penetration of panels when tested in accordance with ASTM E-331-70 at a pressure differential of 7.0 psf.

### 3.1.2 Installation of Gutters and Downspouts

Gutters and downspouts shall be rigidly attached to the building. Spacing of cleats for gutters shall be 16 inches maximum. Spacing of brackets and spacers for gutters shall be 36 inches maximum. Supports for downspouts shall be spaced according to manufacturer's recommendations.

### 3.1.3 Louvers

Louvers shall be rigidly attached to the supporting construction to assure a weather tight installation.

### 3.2 METAL SOFFIT, FASCIA and TRIM

Manufacturer's standard soffit, fascia and trim panel systems shall be assembled and installed in strict compliance with manufacturer's installation instructions. All metal fascia and trim related to the weathertightness of the roofing system shall be compatible with the roofing manufacturer instructions and warranty requirements- see SECTION: 07416A STRUCTURAL STANDING SEAM METAL ROOF (SSMR) SYSTEM for additional information.

### 3.3 FIELD PAINTING

Immediately upon detection, abraded or corroded spots on shop-painted surfaces shall be wire brushed and touched up with the same material used for the shop coat. Factory color finished surfaces shall be touched up as necessary with the manufacturer's recommended touch-up paint.

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY  
FOR  
METAL BUILDING SYSTEM

FACILITY  
DESCRIPTION: \_\_\_\_\_

BUILDING  
NUMBER: \_\_\_\_\_

CORPS OF ENGINEERS CONTRACT  
NUMBER: \_\_\_\_\_

CONTRACTOR

CONTRACTOR: \_\_\_\_\_  
ADDRESS: \_\_\_\_\_

POINT OF  
CONTACT: \_\_\_\_\_

TELEPHONE  
NUMBER: \_\_\_\_\_

OWNER

OWNER: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

POINT OF  
CONTACT: \_\_\_\_\_

TELEPHONE  
NUMBER: \_\_\_\_\_

CONSTRUCTION AGENT

CONSTRUCTION  
AGENT: \_\_\_\_\_  
ADDRESS: \_\_\_\_\_

POINT OF CONTACT: \_\_\_\_\_

TELEPHONE  
NUMBER: \_\_\_\_\_

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY  
FOR  
METAL BUILDING SYSTEM  
(continued)

THE METAL BUILDING SYSTEM INSTALLED ON THE ABOVE NAMED BUILDING IS WARRANTED BY (\_\_\_\_\_) FOR A PERIOD OF FIVE (5) YEARS AGAINST WORKMANSHIP AND MATERIAL DEFICIENCIES, WIND DAMAGE AND STRUCTURAL FAILURE WITHIN PROJECT SPECIFIED DESIGN LOADS, AND LEAKAGE. THE METAL BUILDING SYSTEM COVERED UNDER THIS WARRANTY SHALL INCLUDE, BUT SHALL NOT BE LIMITED TO, THE FOLLOWING: SIDING PANELS AND SEAMS, EXTERIOR GUTTERS AND DOWNSPOUTS, ACCESSORIES, TRIM, FLASHINGS AND MISCELLANEOUS BUILDING CLOSURE ITEMS, CONNECTORS, COMPONENTS, AND FASTENERS, AND OTHER SYSTEM COMPONENTS AND ASSEMBLIES INSTALLED TO PROVIDE A WEATHERTIGHT SYSTEM; AND ITEMS SPECIFIED IN OTHER SECTIONS OF THESE SPECIFICATIONS THAT BECOME PART OF THE METAL BUILDING SYSTEM. ALL MATERIAL AND WORKMANSHIP DEFICIENCIES, SYSTEM DETERIORATION CAUSED BY EXPOSURE TO THE ELEMENTS AND/OR INADEQUATE RESISTANCE TO SPECIFIED SERVICE DESIGN LOADS, WATER LEAKS AND WIND DAMAGE SHALL BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER

ALL MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE AND LEAKAGE ASSOCIATED WITH THE METAL BUILDING SYSTEM COVERED UNDER THIS WARRANTY SHALL BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER. THIS WARRANTY SHALL COVER THE ENTIRE COST OF REPAIR OR REPLACEMENT, INCLUDING ALL MATERIAL, LABOR, AND RELATED MARKUPS. THE ABOVE REFERENCED WARRANTY COMMENCED ON THE DATE OF FINAL ACCEPTANCE ON (\_\_\_\_\_) AND WILL REMAIN IN EFFECT FOR STATED DURATION FROM THIS DATE.

SIGNED, DATED, AND NOTARIZED (BY COMPANY PRESIDENT)

---

(Company President)

(Date)

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY  
FOR  
METAL BUILDING SYSTEM  
(continued)

THE CONTRACTOR SHALL SUPPLEMENT THIS WARRANTY WITH WRITTEN WARRANTIES FROM THE MANUFACTURER AND/OR INSTALLER OF THE METAL BUILDING SYSTEM, WHICH SHALL BE SUBMITTED ALONG WITH THE CONTRACTOR'S WARRANTY. HOWEVER, THE CONTRACTOR WILL BE ULTIMATELY RESPONSIBLE FOR THIS WARRANTY AS OUTLINED IN THE SPECIFICATIONS AND AS INDICATED IN THIS WARRANTY.

EXCLUSIONS FROM COVERAGE

1. NATURAL DISASTERS, ACTS OF GOD (LIGHTNING, FIRE, EXPLOSIONS, SUSTAINED WIND FORCES IN EXCESS OF THE DESIGN CRITERIA, EARTHQUAKES, AND HAIL).
2. ACTS OF NEGLIGENCE OR ABUSE OR MISUSE BY GOVERNMENT OR OTHER PERSONNEL, INCLUDING ACCIDENTS, VANDALISM, CIVIL DISOBEDIENCE, WAR, OR DAMAGE CAUSED BY FALLING OBJECTS.
3. DAMAGE BY STRUCTURAL FAILURE, SETTLEMENT, MOVEMENT, DISTORTION, WARPAGE, OR DISPLACEMENT OF THE BUILDING STRUCTURE OR ALTERATIONS MADE TO THE BUILDING.
4. CORROSION CAUSED BY EXPOSURE TO CORROSIVE CHEMICALS, ASH OR FUMES GENERATED OR RELEASED INSIDE OR OUTSIDE THE BUILDING FROM CHEMICAL PLANTS, FOUNDRIES, PLATING WORKS, KILNS, FERTILIZER FACTORIES, PAPER PLANTS, AND THE LIKE.
5. FAILURE OF ANY PART OF THE BUILDING SYSTEM DUE TO ACTIONS BY THE OWNER WHICH INHIBIT FREE DRAINAGE FROM THE ROOF, AND GUTTERS AND DOWNSPOUTS; OR CONDITIONS WHICH CREATE PONDING WATER ON THE ROOF OR AGAINST THE BUILDING SIDING.
6. THIS WARRANTY APPLIES TO THE METAL BUILDING SYSTEM. IT DOES NOT INCLUDE ANY CONSEQUENTIAL DAMAGE TO THE BUILDING INTERIOR OR CONTENTS WHICH IS COVERED BY THE WARRANTY OF CONSTRUCTION CLAUSE INCLUDED IN THIS CONTRACT.
7. THIS WARRANTY CANNOT BE TRANSFERRED TO ANOTHER OWNER WITHOUT WRITTEN CONSENT OF THE CONTRACTOR AND THIS WARRANTY AND THE CONTRACT PROVISIONS WILL TAKE PRECEDENCE OVER ANY CONFLICTS WITH STATE STATUTES. REPORTS OF LEAKS AND BUILDING SYSTEM DEFICIENCIES SHALL BE RESPONDED TO WITHIN 48 HOURS OF RECEIPT OF NOTICE BY TELEPHONE OR IN WRITING FROM EITHER THE OWNER, OR CONTRACTING OFFICER. EMERGENCY REPAIRS, TO PREVENT FURTHER ROOF LEAKS, SHALL BE INITIATED IMMEDIATELY; A WRITTEN PLAN SHALL BE SUBMITTED FOR APPROVAL TO REPAIR OR REPLACE THIS SSSMR SYSTEM WITHIN SEVEN CALENDAR DAYS. ACTUAL WORK FOR PERMANENT REPAIRS OR REPLACEMENT SHALL BE STARTED WITHIN 30 DAYS AFTER RECEIPT OF NOTICE, AND COMPLETED WITHIN A REASONABLE TIME FRAME. IF THE CONTRACTOR FAILS TO ADEQUATELY RESPOND TO THE WARRANTY PROVISIONS, AS STATED

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY  
FOR  
METAL BUILDING SYSTEM  
(Exclusions from Coverage Continued)

IN THE CONTRACT AND AS CONTAINED HEREIN, THE CONTRACTING OFFICER MAY HAVE THE METAL BUILDING SYSTEM REPLACED OR REPAIRED BY OTHERS AND CHARGE THE COST TO THE CONTRACTOR. IN THE EVENT THE CONTRACTOR DISPUTES THE EXISTENCE OF A WARRANTABLE DEFECT, THE CONTRACTOR MAY CHALLENGE THE OWNER'S DEMAND FOR REPAIRS AND/OR REPLACEMENT DIRECTED BY THE OWNER OR CONTRACTING OFFICER EITHER BY REQUESTING A CONTRACTING OFFICER'S DECISION, UNDER THE CONTRACT DISPUTES ACT, OR BY REQUESTING THAT AN ARBITRATOR RESOLVE THE ISSUE. THE REQUEST FOR AN ARBITRATOR MUST BE MADE WITHIN 48 HOURS OF BEING NOTIFIED OF THE DISPUTED DEFECTS. UPON BEING INVOKED THE PARTIES SHALL, WITHIN 10 DAYS JOINTLY REQUEST A LIST OF FIVE (5) ARBITRATORS FROM THE FEDERAL MEDIATION AND CONCILIATION SERVICE. THE PARTIES SHALL CONFER WITHIN 10 DAYS AFTER RECEIPT OF THE LIST TO SEEK AGREEMENT ON AN ARBITRATOR. IF THE PARTIES CANNOT AGREE ON AN ARBITRATOR, THE CONTRACTING OFFICER AND THE PRESIDENT OF THE CONTRACTOR'S COMPANY WILL STRIKE ONE (1) NAME FROM THE LIST ALTERNATIVELY UNTIL ONE NAME REMAINS. THE REMAINING PERSON SHALL BE THE DULY SELECTED ARBITRATOR. THE COSTS OF THE ARBITRATION, INCLUDING THE ARBITRATOR'S FEE AND EXPENSES, COURT REPORTER, COURTROOM OR SITE SELECTED ETC., SHALL BE BORNE EQUALLY BETWEEN THE PARTIES. EITHER PARTY DESIRING A COPY OF THE TRANSCRIPT SHALL PAY FOR THE TRANSCRIPT. A HEARING WILL BE HELD AS SOON AS THE PARTIES CAN MUTUALLY AGREE. A WRITTEN ARBITRATOR'S DECISION WILL BE REQUESTED NOT LATER THAN 30 DAYS FOLLOWING THE HEARING. THE DECISION OF THE ARBITRATOR WILL NOT BE BINDING; HOWEVER, IT WILL BE ADMISSIBLE IN ANY SUBSEQUENT APPEAL UNDER THE CONTRACT DISPUTES ACT. A FRAMED COPY OF THIS WARRANTY SHALL BE POSTED IN THE MECHANICAL ROOM OR OTHER APPROVED LOCATION DURING THE ENTIRE WARRANTY PERIOD.

-- End of Section --

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DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13210A

STEEL WATER TANKS

02/02

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-- End of Section Table of Contents --

## SECTION 13210A

STEEL WATER TANKS  
02/02

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA C600 (1999) Installation of Ductile-Iron Water Mains and Their Appurtenances

AWWA D100 (1996) Welded Steel Tanks for Water Storage

## NSF INTERNATIONAL (NSF)

NSF 61 (1999) Drinking Water System Components - Health Effects (Sections 1-9)

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

## Tank Installation; G-DO

Detail and erection drawings, before proceeding with any fabrication. The drawings shall be complete with details of steel, pipe, and with details of the assembling of items required for the complete installation. Standard welding symbols as recommended by the American Welding Society shall be used. Details of welded joints referenced on the drawings shall be included.

## SD-03 Product Data

## General Requirements; G-DO

Design Analyses and Calculations, including copies of drawings showing the overall tank plans and location of ladders, catwalks, etc. Drawings showing the general support framing shall also be provided.

## SD-06 Test Reports

## Tank Installation; G-AO

Copies of the following test results:

- a. Manufacturer's mill test reports for plate material.
- b. Mill and shop inspections by a commercial inspection agency.
- c. At the conclusion of the work, a written report prepared by the Contractor covering the hydrostatic test and certifying that the work was inspected in accordance with Section 11.2.1 of AWWA D100.

## SD-07 Certificates

## General Requirements; G-AO

Certification by an independent third-party organization that all interior coating and materials that come in contact with the water comply with NSF 61.

A certificate signed by a registered professional engineer, providing the following information:

- a. Description of the structural design loading conditions used for the design of entire tank including the support framing.
- b. Description of the structural design method and codes used in establishing the allowable stresses and safety factors applied in the design.
- c. A statement verifying that the structural design has been checked by experienced engineers specializing in hydraulic structures.
- d. A statement verifying that the detail drawings have been checked by experienced engineers specializing in hydraulic structures to determine that they agree with the design calculations in member sizes, dimensions, and fabricating process as prescribed by applicable AWWA standards.

## 1.3 GENERAL REQUIREMENTS

## 1.3.1 Design and Construction Standards

The design fabrication, and erection of the tanks shall be in accordance with the applicable requirements of AWWA D100 except as modified herein. Earthquake design acceleration (lateral force) shall be as indicated (See Drawing M8.13). No additional thickness for corrosion allowance will be required. The tank tops shall be designed for either a uniform live load of 25 psf or a concentrated load of 200 lbs over a 4 sq in area applied at a location producing maximum stresses. Tanks and all non-galvanized integral items such as ladders, railings, catwalks, covers, brackets and support frames shall be painted in accordance with specification Section 09965A PAINTING: STEEL TANK STRUCTURES.

## 1.3.2 Qualification of Welding Procedures, Welders, and Welding Operators

Section 8.2 of AWWA D100.

### 1.3.3 Design Requirements

Tanks shall have the indicated internal dimensions. The tank wall and floor structure shall not exceed 6" in overall thickness. After contract award, the Contractor may propose use of tanks of similar dimensions and capacities to those indicated; however acceptance of such tanks will be at the Government's discretion, and rejection of the proposed tanks shall not be considered cause for claims. In addition, if accepted, the Contractor shall be responsible for all design and construction changes (e.g. changes to the mezzanine structure, piping, etc.) necessary to accommodate the alternative tanks, and shall submit such changes for approval. Tanks shall be of the style shown.

Framing supporting elevated tanks shall be constructed of structural shapes of the open type, or of tubular sections. The supporting frames shall be thoroughly braced with horizontal struts and diagonal ties as required to resist horizontal and buckling forces. Supports shall be designed to limit reactions to that indicated on Drawing S2.08. Column splices shall be as few as possible and shall be located as near as practicable to the intersection of the centerline of the struts. Splice plates shall be welded so as to hold the members in line and transmit any tension or shearing stresses to which the members may be subjected. The connections of the tank to the support framing shall be made to distribute the load properly over the column sections and over the shell of the tank.

Ladders, catwalks and railing shall be designed for appropriate loads. Ladders, catwalks and railing may be field installed using bolted connections. No field welding to tanks will be allowed. Ladders shall have a width of approximately 20 inches, with side members extending 42 inches beyond the upper level and rungs spaced at 12". Rails and their supporting connections shall be designed to resist a horizontal force of 200 lbs at any point on the railing. Rails shall have at least two horizontal members, with the top of the rail at approximately 42" above the surface and the second rail at approximately 22 Inches above the surface. Catwalks shall be designed for either 1) a uniform live load of 40 psf or 2) a concentrated load of 300 lbs over 4 sq inches located to produce maximum stress, whichever is most severe. Catwalks shall be secured as required to prevent displacement, but need not be secured to all supports. Catwalk floor plates shall be at least 1/4 inch thick treadplate, or may be fabricated of expanded metal. See Specification SECTION 05500a for additional requirements.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Materials shall conform to the following requirements:

#### 2.1.1 Steel

Section 2 of AWWA D100.

#### 2.1.2 Shop Fabrication

Section 9 of AWWA D100.

#### 2.1.3 Specials and Fittings

Specials and fittings shall be carbon steel or ductile iron as indicated in the drawings and as specified in specification Section: 15200A PIPELINES, LIQUID PROCESS PIPING. See drawing M8.03 for requirements for sensor standpipes and stopper standpipes.

## 2.2 ASSEMBLIES

### 2.2.1 Accessories for Tanks

As indicated. Additional requirements for accessories are as follows:

#### 2.2.1.1 Ladders and Safety Devices

Location of ladders shall be approximately as shown on the drawings. Exact location of ladders, railings and catwalks shall be indicated in the shop drawings and shall be subject to approval. In addition, safety cage, roof ladder handrails, and other safety devices shall be provided as required by federal or local laws or regulations.

## PART 3 EXECUTION

### 3.1 TANK INSTALLATION

Tank installation shall be in accordance with the following requirements:

#### 3.1.1 Welding

Section 8 of AWWA D100.

#### 3.1.2 Erection

In accordance with applicable portions of Section 10 of AWWA D100, except that no welding shall be permitted on tanks after they have been painted. Tanks shall be shipped as complete units. Accessories such as ladders, railings, catwalks, fittings and support framing may be shipped separately.

Tanks shall be levelled using galvanized steel shims no smaller in area than the members they support. Shims shall be neatly installed and trimmed. Tanks shall be anchored as indicated. Contractor shall be responsible for final tank positioning and for completing connections, including labor and materials, to adjacent equipment.

#### 3.1.3 Inspections and Testing

Tank inspection and testing shall be in accordance with Section 11 of AWWA D100. Mill and shop inspections are required and shall be performed by an approved commercial inspection agency. All welds shall be visually inspected. Radiographic inspection is not required. The Contractor shall perform the hydrostatic test. Final hydrostatic test shall be performed before painting. The tanks shall be hydrostatically tested prior to painting by filling with water to the bottom of the roof framing. Testing shall also be performed after installation of the tanks and all process piping is completed. (Also see specification Section 15200A PIPELINES, LIQUID PROCESSING.)

### 3.2 PIPING INSTALLATION

#### 3.2.1 General Guidelines

Where details of fabrication or installation are not shown on the drawings, installation shall conform to Section 1 and 3 of AWWA C600.

3.2.2 Plugging Ends

Pipe ends left for future connections shall be securely covered to prevent entry of dust and animals.

3.3 PAINTING AND COATING OF TANK

Painting shall be in accordance with specification Section 09965A PAINTING, STEEL TANK STRUCTURES.

3.4 CLEANING PRIOR TO SERVICE

Tank interiors and connections shall be thoroughly cleaned of all dust, dirt, film and other contamination after installation and again after just prior to being placed into service. Tanks shall have all openings securely covered after cleaning to prevent entry of contaminants and animals. Tanks and piping shall be thoroughly flushed with process water prior to turnover.

-- End of Section --

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SECTION 13401N

FLOW MEASURING EQUIPMENT

09/99

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-- End of Section Table of Contents --

## SECTION 13401N

## FLOW MEASURING EQUIPMENT

09/99

## PART 1 GENERAL

## 1.1 SYSTEM REQUIREMENTS

The flow measuring equipment shall be the paddle wheel/turbine type or propeller meter type. The design shall permit ease of installation and shall not have any features hazardous to personnel or detrimental to the equipment. Provision shall be made to align and adequately lubricate moving parts. Interior parts shall be easily accessible for adjustment, repair, and replacement.

## 1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-03 Product Data; GA-DO

Flow measuring equipment components

Read-out device

SD-06 Test Reports

Flow measuring equipment calibration

SD-08 Manufacturer's Instructions

Flow measuring equipment components

Submit manufacturer's written recommendation for installation and handling.

## 1.3 QUALITY ASSURANCE

## 1.3.1 Requirements

Submit as required in paragraph entitled "Field Tests and Inspections."

## PART 2 PRODUCTS

## 2.1 MATERIALS AND EQUIPMENT

Unless otherwise specified, all materials and equipment shall be standard commercial products in regular production by the manufacturer and suitable for the required service.

## 2.1.1 Paddle wheel/Turbine type Meter

Provide insertion-type paddle wheel/turbine type meters where indicated. The meter shall measure the velocity and convert it to flow units. The meter shall have a range of 0 to 6000 gpm for Flow Monitor #1 (Raw water

measurement), 0 - 3000 gpm for Flow Monitor #2 (Cold/Treated Water) and 0 - 1500 gpm for Flow Monitor #3 (Heater/Treated water). The flow range for the flow monitor for the Energy Recovery Water (ERW) shall be 0-1000 gpm. Meters shall be similar to SeaMetrics, Inc. models IP115/215 or TX115/215.

Equivalent meters from other manufacturers shall be acceptable. The main casing of the meters shall be bronze, brass or stainless steel. Bearings shall be jewel-type. Connections shall utilize integral isolation valves to enable removal of the meter without interrupting service. Working pressure shall be 125 psi. Accuracy for either meter type shall be plus or minus 2 percent of actual rate over a 10 to 1 range.

## 2.2 READ-OUT DEVICE

Provide the meter with the following read-out device which shall read the ranges defined within the preceding paragraph. Also see specification Section 13405A Process Control for additional requirements, including alarms.

### 2.2.1 Local Read-Out and Remote Transmission

Provide an indicating transmitter for local read-out and transmission of flow data to remote read-out. The read-out shall be visible through a shatterproof clear window. The read-out and transmission mechanism shall not be affected by the intended end use of environment. The unit shall digitally display current and total flow, and shall have a non-volatile memory or battery back-up. The transmission shall be impulse duration type or milliampere dc analog signal type to the remote read-out. Actuate all transmission by the output motion or the ac voltage signal of the meter. Provide power supply as required for unit. The unit shall be non-corrosive and weatherproof or provided with a separate weatherproof housing with a sealed door for access to the mechanism, and designed to prevent the accumulation of moisture or fog inside the case. Provide a suitable mounting.

#### 2.2.1.1 Display

The display shall be a minimum of 4 inches long, with readings easily legible from a distance of 36 inches.

### 2.2.2 Remote Read-Out

Provide an indicator and a recorder for remote read-out of flow. The read-out shall accept the signal output and be of the same range and flow units as the local read-out and remote transmission device. The signal shall actuate receiver in which the input duplicates the output of the remote transmission device. The unit shall digitally display current and total flow, and shall have a non-volatile memory or battery back-up. AC or DC power supply shall be provided, if required. The read-out shall be visible through a shatterproof clear window. The read-out shall not be affected by the intended end use environment. The unit shall be weatherproof or provided with a separate weatherproof housing with a sealed door for access to the mechanism, and designed to prevent the accumulation of moisture or fog inside the case. Provide a suitable mounting.

#### 2.2.2.1 Remote Read-Out Display

Shall be a minimum of 4 inches long, with readings easily legible from a distance of 36 inches.

## 2.3 ELECTRICAL REQUIREMENTS

Unless indicated or specified otherwise, the electrical components of the meters, such as electrical disconnecting (isolating) means, are included under this section. Provide wiring for signal circuit as specified by the equipment manufacturer. The interconnecting conduit and wire (except when otherwise specified herein, or when included in factory-assembled equipment) and the electrical connection of the meters to the electrical power circuit are specified in Division 16.

#### 2.4 SPARE PARTS

Provide all standard recommended spare parts as specified in the manufacturer's instruction manuals for each component in the system.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Furnish the services of a representative of the manufacturer of the flow measuring equipment for checking the installation, making the necessary adjustments and calibrations, placing the equipment in operation, and performing the acceptance tests. The representative also shall be available for not less than 1 day to instruct operating personnel in the use, operation, and maintenance of the equipment during the initial operating period. Install all flow measuring equipment in accordance with the recommendations of the manufacturer. Fluid flow instruments shall be installed in accordance with ASME FED, unless otherwise indicated in the specification. The minimum straight unobstructed piping for the flowmeter installation shall be as recommended by the meter manufacturer. Turbine and paddlewheel meters shall be installed so that the sensor is located in the center of the fluid flow pipe on the main axis unless otherwise recommended by the manufacturer.

#### 3.2 FIELD TESTS AND INSPECTIONS

Test and calibrate in place the flow measuring equipment to demonstrate that it meets the accuracy requirements for the full range of flows specified herein. Provide all labor, equipment, and incidentals required for the tests, including electric power and water required for tests. The Contracting Officer will witness all field tests and conduct all field inspections. The Contractor shall give the Contracting Officer ample notice of the dates and times scheduled for tests. Rectify any deficiencies found and retest work affected by such deficiencies at the Contractor's expense. Record data from each field test shall be recorded and documented in a formal field test report.

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## SECTION 13405A

## PROCESS CONTROL

01/03

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.1	(2001) Electric Meters Code for Electricity Metering
ANSI C37.90	(1989) Relays and Relay Systems Associated with Electric Power Apparatus
ANSI C37.90.1	(1989) Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems
ANSI X3.154	(1988; R 1994) Office Machines and Supplies - Alphanumeric Machines-Keyboard Arrangement
ANSI X3.64	(1979; R 1990) Additional Controls For Use With the American National Standard Code for Information Interchange

## ASTM INTERNATIONAL (ASTM)

ASTM A 536	(1984; R 1999e1) Ductile Iron Castings
ASTM B 88	(1999e1) Seamless Copper Water Tube
ASTM B 88M	(1999) Seamless Copper Water Tube (Metric)
ASTM D 1238	(2001) Melt Flow Rates of Thermoplastics by Extrusion Plastometer
ASTM D 1693	(2001) Environmental Stress-Cracking of Ethylene Plastics
ASTM D 2000	(2001) Rubber Products in Automotive Applications
ASTM D 635	(1998) Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
ASTM D 638	(2001) Tensile Properties of Plastics
ASTM D 638M	(1996) Tensile Properties of Plastics

- (Metric)
- ASTM D 792 (2000) Density and Specific Gravity (Relative Density) of Plastics by Displacement
- AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)
- ASHRAE Hdbk-IP (2001) Fundamentals Handbook, I-P Edition
- AMERICAN WATER WORKS ASSOCIATION(AWWA)
- AWWA C606 (1997) Grooved and Shouldered Joints
- ASME INTERNATIONAL (ASME)
- ASME B31.8 (2000) Gas Transmission and Distribution Piping Systems
- ASME BPVC SEC VIII D1 (2001) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage
- ASME FED (1971; Sixth Edition) Fluid Meters Their Theory and Application
- ELECTRONIC INDUSTRIES ALLIANCE (EIA)
- EIA ANSI/EIA/TIA-232-F (1997) Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange
- INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)
- IEEE C62.41 (1991) Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits
- IEEE Std 100 (2000) IEEE Standard Dictionary of Electrical and Electronics Terms
- IEEE Std 142 (1992) Recommended Practice for Grounding of Industrial and Commercial Power Systems - Green Book
- IEEE Std 8802-3 (2000) Local Area Networks: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications
- IEEE Std 8802-4 (1990) Information processing systems - Local area networks - Part 4: Token-passing bus access method and physical layer specifications
- INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)
- IEC 61131-3 (1993) Programmable Controllers - Part 3:

## Programming Languages

## INTERNATIONAL TELECOMMUNICATION UNION (ITU)

- ITU V.34 (1998) Data Communication Over the Telephone Network: A Modem Operating at Data Signaling Rates of up to 28,800 bits for use on the General Switched Telephone Network and on Leased Point-to-Point Two-Wire Telephone Type Circuits
- ITU V.42 bis (1990) Data Communication Over the Telephone Network: Data Compression Procedures for Data Circuit Terminating Equipment (DCE) Using Error Correction Procedures

## ISA - THE INSTRUMENTATION, SYSTEMS AND AUTOMATION SOCIETY (ISA)

- ISA MC96.1 (1982) Temperature Measurement Thermocouples
- ISA S7.0.01 (1996) Quality Standard for Instrument Air

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- NEMA 250 (1997) Enclosures for Electrical Equipment (1000 Volts Maximum)
- NEMA ICS 1 (2001) Industrial Control and Systems
- NEMA ICS 2 (2002) Industrial Controls and Systems Controllers, Contactors, and Overload Relays Rated Not More Than 2,000 Volts AC or 750 Volts DC
- NEMA ICS 3 (1993) Industrial Control and Systems Factory Built Assemblies
- NEMA ICS 4 (2000) Industrial Control and Systems Terminal Blocks

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 70 (2002) National Electrical Code

## NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

- NIST SP 250 (1998) Calibration Service Users Guide

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

- 40 CFR 60 Standards of Performance for New Stationary Sources
- 47 CFR 15 Radio Frequency Devices
- 47 CFR 68 Connection of Terminal Equipment to the Telephone Network

## UNDERWRITERS LABORATORIES (UL)

UL 1059	(2001; 4th Edition) Terminal Blocks
UL 508	(1999; Rev thru Dec 2001) Industrial Control Equipment
UL 94	(1996; Rev thru May 2001) Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

## 1.2 CONTROL SYSTEM DESCRIPTION

The process instrumentation and control system shall be used to monitor and control the operation of process equipment as specified and in accordance with the sequence of control and control schematics shown on the drawings. The control system shall provide for operator interaction, overall control system supervision, and process equipment control and monitoring. The Contractor shall provide hardware configured and sized to support expansion as specified and shown on the drawings.

## 1.2.1 Control System General Requirements

The control system shall consist of level sensors, flow monitors, temperature sensors and pressure transducers designed to control the process flowrate, process blowers, process water temperature, filtration, and treatment and the elevation of water within the various process units.

## 1.2.2 Control System Operation

The control system provided under this specification shall operate using direct digital control (DDC) algorithms or ladder logic type and supervisory control to provide the required sequences of operation. Input data to the controller shall be obtained by using instruments and controls interfaced to mechanical, electrical, utility systems and other systems as shown and specified. All required setpoints, settings, alarm limits, and sequences of operation shall be as identified in the sequences of operation shown on the drawings. The number and location of control panels shown on drawings shall be provided as a minimum.

## 1.2.3 Control System Points

Inputs to and outputs from the control system shall be in accordance with the process instrumentation and control diagrams shown on the drawings. Each connected analog output (AO), analog input (AI), digital output (DO), digital input (DI), pulse accumulator (PA) input and other input or output device connected to the control system shall represent a "point" where referred to in this specification.

## 1.2.4 Symbols, Definitions, and Abbreviations

Symbols, definitions, and engineering unit abbreviations shall conform to IEEE Std 100, as applicable.

## 1.3 ENVIRONMENTAL CONDITIONS

Capacity and design of the air moving equipment and accessories shall be suitable for 24-hour full load service and shall meet the following

criteria.

a. Location

Latitude 48.  
 Longitude 106.  
 Altitude (above MSL) 2075 ft.

b. Heating Degree Days 9251.

c. Winter Design Temperatures

Outside Air (Ventilation) -22 (99%).  
 Outside Air (Heat Loss) -18 (97.5%).  
 Inside Air Temperature 50 degrees F.

d. Cooling Degree Days 404.

e. Summer Design Temperatures

Outside Air (Ventilation) 92 DB (1%).  
 Outside Air (Ventilation) 64 MCWB (1%).  
 Outside Air (Heat Minimum) 89 DB (2.5%).  
 Outside Air (Heat Minimum) 63 (2.5%).  
 Inside Air Temperature 85 degrees F.

f. Contaminants humidity, dust, dirt.

#### 1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation; G-DO  
 Wiring; G-DO

Detail drawings containing complete piping, wiring, schematic, flow diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Piping and Instrumentation (P&ID) drawings (prepared using industry recognized device symbols, clearly defined and describing piping designations to define the service and materials of

individual pipe segments and instrument tags employing Instrument Society of America suggested identifiers). Drawings shall include, as appropriate: product specific catalog cuts; a drawing index; a list of symbols; a series of drawings for each control system using abbreviations, symbols, nomenclature and identifiers as shown; valve schedules; compressed instrument air station schematics and ASME air storage tank certificates for each type and make of compressed instrument air station.

#### SD-03 Product Data

Instrumentation and Control System; G-DO

Manufacturer's descriptive and technical literature, performance charts and installation instructions. Product specific catalog cuts shall be in booklet form, indexed to the unique identifiers, and shall consist of data sheets that document compliance with the specification. Where multiple components are shown on a catalog cut, the application specific component shall be marked.

Sensors and Meters; G-DO

Manufacturer's descriptive and technical literature, catalog cuts, performance charts and installation instructions.

Training Manual; G-AO

Instruction manual within 60 days following Notice to Proceed.

Performance Verification Test (PVT); G-AO

The performance verification test procedure; it shall refer to the actions and expected results to demonstrate that the control system performs in accordance with the sequence of control. A list of the equipment to be used during the testing shall be included. The list shall also include manufacturer's name, model number, equipment function, the date of the latest calibration and the results of the latest calibration.

Factory Test Procedure; G-AO

Documentation containing factory test methods and procedures.

#### SD-06 Test Reports

Factory Test Report; G-AO  
Testing, Adjusting and Commissioning; G-AO  
Performance Verification Test(PVT); G-AO  
Endurance Test; G-AO

Test results in report format.

#### SD-07 Certificates

Control and Sensor Wiring; G-AO

Certified test results for surge protection.

Ground Rods; G-AO

Certification stating that the test was performed in accordance with IEEE Std 142.

#### SD-10 Operation and Maintenance Data

##### Instrumentation and Control System; G-AO

Six complete copies of operating instructions outlining the step-by-step procedures required for system startup, operation and shutdown. The instructions shall include layout, wiring and control diagrams of the system as installed. The instructions shall include the manufacturer's name, model number, service manual, parts list and a brief description of all equipment and their basic operating features.

Six complete copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs and trouble shooting guides.

#### 1.5 DATA TRANSMISSION SYSTEMS (DTS)

Data transmission systems for communication between PLCs shall be provided as shown on the drawings and defined in other specification sections.

#### 1.6 EQUIPMENT REQUIREMENTS

##### 1.6.1 Materials and Equipment

Materials and equipment shall be standard unmodified products of a manufacturer regularly engaged in the manufacturing of such products. Units of the same type of equipment shall be products of a single manufacturer. Items of the same type and purpose shall be identical and supplied by the same manufacturer, unless replaced by a new version approved by the Government.

##### 1.6.2 Nameplates

Each major component of equipment shall have the manufacturer's name and address, and the model and serial number in a conspicuous place. Laminated plastic nameplates shall be provided for equipment devices and panels furnished. Each nameplate shall identify the device, such as pump "P-1" or valve "VLV-402". Labels shall be coordinate with the schedules and the process and instrumentation drawings.

#### PART 2 PRODUCTS

##### 2.1 GENERAL REQUIREMENTS

Equipment located outdoors, not provided with climate controlled enclosure, shall be capable of operating in the ambient temperature range indicated in paragraph ENVIRONMENTAL CONDITIONS, unless otherwise specified. Note that equipment in the mechanical room will be subject to high humidity. Electrical equipment shall conform to Section 16415A ELECTRICAL WORK, INTERIOR. Equipment and wiring must be in accordance with NFPA 70, with proper consideration given to environmental conditions such as moisture, dirt, corrosive agents, and hazardous area classification.

##### 2.2 MONITORING AND CONTROL PARAMETERS

The control system shall be complete including sensors, field preamplifiers, signal conditioners, offset and span adjustments, amplifiers, transducers, transmitters, control devices, engineering units conversions and algorithms for the applications; and shall maintain the specified end-to-end process control loop accuracy from sensor to display and final control element. Control equipment shall be powered by a 120 vAc, single phase, 60 Hz power source, with local transformers included as needed for signal transmission and subsystem operation. Connecting conductors shall be suitable for installed service. Enclosures shall be rated for the appropriate NEMA classification and hazard environment.

#### 2.2.1 AUTOMATIC CONTROL VALVES

Valves shall have stainless-steel stems and stuffing boxes with extended necks to clear the piping insulation. Valve bodies shall be designed for not less than 125 psig working pressure or 150 percent of the system operating pressure, whichever is greater. Valve leakage rating shall be 0.01 percent of rated Cv.

#### 2.4.2.1 Three-way control valve

Three-way valves shall provide linear flow control with constant total flow throughout full plug travel. Valves for hot water service below 210 degrees F or less shall have brass or bronze bodies. Nonmetallic parts of hot-water control valves shall be suitable for a minimum continuous operating temperature of 250 degrees F or 50 degrees F above the system design temperature, whichever is higher. Valves 4 inches and larger shall be butterfly valves.

##### 2.2.1.1 Valve Actuators

Valve actuators shall be selected to provide a minimum of 125 percent of the motive power necessary to operate the valve over its full range of operation.

#### 2.2.1 Transmitter

Unless indicated otherwise, each sensor shall be provided with a transmitter, selected to match the sensor. Except where specifically indicated otherwise on the drawings, the transmitter shall be provided with a four digit or analog visual display of the measured parameter and shall provide a 4 to 20 mA<sub>dc</sub> output signal proportional to the level of the measured parameter. Accuracy shall be plus or minus 1 percent of full scale reading with output error not exceeding plus or minus 0.25 percent of the calibrated measurement. Transmitter shall be located where indicated, mounted integrally with the sensor, pipe mounted, wall mounted or installed in the control panel. The distance between the sensor and transmitter shall not exceed the manufacturer's recommendation. Field preamplifiers and signal conditioners shall be included when necessary to maintain the accuracy from sensor to the programmable logic controller or recorder.

#### 2.2.2 Liquid Service

Sensors and meters in liquid service shall be rated for continuous duty service at fluid approach velocities from 0.327 ft/s to 10 ft/s with correspondingly higher constriction velocities over a fluid temperature range from 32 degrees F to 85 degrees F at pressures up to 100 psi gauge.

### 2.2.3 Flow Sensor

Liquid flow indication shall be provided in gpm. Pressure taps shall incorporate appropriate snubbers. Unless indicated otherwise, the flow transmitter shall produce a signal that is proportional to the volumetric flow rate, compensated for fluid temperature, and shall have an accuracy of plus or minus 2 percent of the actual flow. Flow transmitter shall be located within 15 feet of the flow element. The flow transmitter shall include a digital readout of the volumetric flow rate to 3 significant figures. Alarm levels for the flow sensor shall be individually adjustable. The controller shall be provided with an audible warning horn that sounds when the upper detection level has been exceeded, and a warning horn silence button. The controller shall provide a 4-20 mAdc output signal to the programmable logic controller, proportional to the measured parameter. The controller shall be provided with an internal battery to maintain operation for a minimum of 12 hours if power is lost. Flow rate shall be controlled to within plus or minus 5 percent of the design flow. Also see specification Section 13401A Flow Measuring Equipment.

#### 2.2.3.1 Flow Switch

Flow switch shall have a repetitive accuracy of plus or minus 10 percent of actual flow setting. Switch actuation shall be adjustable over the operating flow range. Flow switch for use in water systems shall be rated for use and constructed of suitable materials for installation in the environment encountered. The flow switch shall have non flexible paddle with Form C snap action contacts, rated in accordance with NEMA ICS 1.

### 2.2.4 Level Instrumentation

Pressure taps shall incorporate appropriate snubbers. Relays and housing shall be intrinsically safe or explosion proof as required by the NFPA hazard rating for compatibility with the contents of the tank or sump. The controller shall be provided with a minimum number of points as indicated in the contract drawings. The alarm levels shall be individually adjustable. The controller shall be provided with an audible warning horn that sounds when the upper detection level has been exceeded, and a warning horn silence button. The controller shall provide a 4-20 mAdc output signal to the programmable logic controller, proportional to the measured parameter. The controller shall be provided with an internal battery to maintain operation for a minimum of 12 hours if power is lost.

#### 2.2.4.1 Ultrasonic Sensor

The sensor shall be microprocessor based and shall provide continuous, non-contact level measurement of liquids utilizing microwave pulsed time of flight measurement method. The sensor shall operate in a frequency band approved for industrial use. The sensor shall be capable of measuring in a range of 0 to 10 feet with an accuracy of plus or minus 1 percent of full scale. The sensor shall be capable of distinguishing between real echoes, reflections and background noise. The sensor shall automatically compensate for temperature changes. The sensor shall be capable of operating in a temperature range from 0 degrees F to 120 degrees F. Assembly shall be flange mounted or NPT thread (male) include surface mounting bracket of sufficient size to eliminate echoing and suitable for the installed environment indicated. Mounting assembly shall be suitable for service without requiring entry or drainage of the vessel where level is being measured. Standpipes shall be provided as recommended by the

sensor manufacturer and as required to eliminate inaccurate or false readings.

#### 2.2.5 Pressure Instrumentation

Pressure taps shall incorporate appropriate snubbers. The controller shall be provided with the control information as defined on the contract drawings. The controller shall be provided with an audible warning horn that sounds when the upper detection level has been exceeded, and a warning horn silence button. The controller shall provide a 4-20 mA<sub>dc</sub> output signal to the programmable logic controller, proportional to the measured parameter. The controller shall be provided with an internal battery to maintain operation for a minimum of 12 hours if power is lost. Pressures shall be controlled to within plus or minus 5 percent of design pressures.

##### 2.2.5.1 Pressure Sensor

The sensing element shall be either capsule, diaphragm, bellows, Bourdon tube, or solid state as applicable for the installation. The pressure transducer shall withstand up to 300 percent of rated pressure, with an accuracy of plus or minus 1.0 percent of full scale selected to put the design range of the measured pressure in the middle third of the transducer's range. Pressure shall be measured in psi gage with a range, plus or minus 10 percent of design range and shall be furnished with display to the nearest 0.145 psi. The transmitter output error shall not exceed 0.1 percent of calibrated span.

##### 2.2.5.2 Pressure Switch

Sensors shall be diaphragm or Bourdon tube and shall be constructed of brass or 316 stainless steel. Pressure switch shall have a repetitive accuracy of plus or minus 5.0 percent of the operating range and shall withstand up to 150 percent of rated pressure. Switch actuation set point shall be adjustable over the operating pressure range with a differential adjustment span of 20 to 40 percent of the range of the switch. The switch shall have Form C snap-action contacts rated in accordance with NEMA ICS 1.

##### 2.2.5.3 Differential Pressure

The sensor/transmitter assembly accuracy shall be plus or minus 2 percent of full scale. The over pressure rating shall be a minimum of 300 percent of the operating pressure. Transmitter shall be suitable for installation with the low pressure connection removed.

##### 2.2.5.4 Differential Pressure Switch

Each switch shall be an adjustable diaphragm, or bellows operated device, with taps for sensing lines for connection of pressure fittings designed to sense fluid pressure. The adjustable differential range shall be a maximum of 0.15 inches water at the low end to a minimum of 0.35 inches water at the high end. Two Form C contacts rated in accordance with NEMA ICS 1 shall be provided.

##### 2.2.5.5 Pneumatic to Electric (PE) Switch

Each switch shall have an adjustable set point range of 3.0 to 20 psi gage and an adjustable differential from 2.0 to 6.0 psi. Contacts shall be Form C rated in accordance with NEMA ICS 1.

### 2.2.6 Temperature Instrumentation

The controller shall be provided with the control capabilities defined on the contract drawings. The controller shall be provided with an audible warning horn that sounds when the upper detection level has been exceeded, and a warning horn silence button. The controller shall provide a 4-20 mA Dc output signal to the programmable logic controller, proportional to the measured parameter. The controller shall be provided with an internal battery to maintain operation for a minimum of 12 hours if power is lost.

#### 2.2.6.1 Fluid Temperature Range

All devices shall be suitable for process temperatures, which define the exposure of the element. Mercury shall not be used in thermometers.

- a. Type A shall be bimetal thermometer: Direct reading, hermetically sealed, suitable for external adjustment. Accurate within 1 percent of full range. Stainless steel construction. Complete with thermowell.
- b. Type B shall be remote reading gas/vapor thermometer: Direct reading, stainless steel or phenolic case designed for panel mounting, complete with armor cable, bulb and ancillary components for complete system. Movementless design, resistant to shock and vibration and free from error created by elevation. Provided with gas operated molecular sieve. Accurate within 1 percent over full range.

#### 2.2.6.2 Continuous Averaging RTD

Continuous averaging RTD shall have an accuracy of plus or minus 0.9 degrees F at the reference temperature, and shall be of sufficient length to ensure that the resistance represents an average over the cross-section in which it is installed. The sensor shall have a bendable copper sheath.

#### 2.2.6.3 Temperature Switch

All devices shall be suitable for process temperatures, which define the exposure of the element. Temperature switch shall have a repetitive accuracy of plus or minus 1 percent of the operating ranges shown. Switch actuation shall be adjustable over the operating temperature range. The switch shall have Form C snap action contacts, rated in accordance with NEMA ICS 1.

#### 2.2.6.4 Thermowell

Thermowell shall be monel, brass, or copper for use in water lines; wrought iron for measuring flue gases; and austenitic stainless steel for other applications. Calibrated thermowells shall be provided with threaded plug and chain, 2 inch lagging neck and inside diameter insertion neck as required for the application. The thermowell shall include a connection box, sized to accommodate the temperature sensing device.

#### 2.2.7 Auto-Dialer Instrumentation

See electrical drawing E5.02 for information related to auto-dialer requirements. Two auto-dialers shall be provided under this contract - one for fire alarm annunciation, and the other for hatchery process control dialout to the hatchery manager and/or staff. The auto-dialers shall be

suitable for the required application. Adequate input points shall be provided to address a minimum of sixteen separate control malfunction signals.

#### 2.2.8 Electrical Instrumentation

Electrical power measurements with a range for the specific application, plus or minus 1.0 percent of range (display and print to nearest kWh and kW). Electrical measurements with a range for the specific application plus or minus 1.0 percent of range (display and print to nearest 0.1 for volts and amperes, and to the nearest 0.01 for VAR and PF).

##### 2.2.8.1 Hour Meter

Hour meter shall provide a totalized readout of the number of hours of operation for the equipment monitored. Meter shall provide readout with a minimum of 6 digits including 1 decimal places. The display shall be non-resettable. The meter shall be driven by a 24 or 120 vAc synchronous motor.

#### 2.2.9 Miscellaneous Measurements

Miscellaneous measurements with a range for the specific application plus or minus 1.0 percent of range (display and print to nearest 0.1 of the specified units).

### 2.3 COMPRESSED AIR STATIONS

#### 2.3.1 Air Compressor Assembly

Air compressors and accessories shall be in accordance with section 15400A, PLUMBING , GENERAL PURPOSE.

#### 2.3.2 Compressed Air Piping

Control air delivered to the system shall conform to ISA S7.0.01. Air lines for pneumatic controls shall be seamless copper tubing or nonmetallic tubing. Nonmetallic tubing shall be compounded from polyethylene. Air lines concealed in walls shall be hard-drawn copper tubing or nonmetallic tubing in rigid conduit. Terminal single lines shall be hard-drawn copper tubing except when the run is less than 12 inches in length, flexible polyethylene may be used. Nonmetallic tubing will not be used for applications where the tubing could be subjected to a temperature exceeding 130 degrees F. Fittings for nonmetallic tubing shall be for instrument service and may be brass or acetyl resin of the compression or barbed push-on type. Tubing shall be as follows:

- a. Copper tubing shall conform to ASTM B 88 and shall have sweat fittings and valves. Exposed tubing shall be hard drawn in exposed areas and hard-drawn or annealed in concealed areas. Only tool made bends shall be used. Fittings for copper tubing shall be brass or copper solder joint type except at connections to the apparatus, where fittings shall be brass compression type. Grooved mechanical joints and fittings shall be designed for not less than 125 psig service and shall be the product of the same manufacturer. Grooved fittings and mechanical coupling housing shall be ductile conforming to ASTM A 536. Gaskets for use in grooved joints shall be molded synthetic polymer of pressure

responsive design and shall conform to ASTM D 2000 for circulating medium up to 230 degrees F. Grooved joints shall conform to AWWA C606. Tubing shall be rack mounted where multiple tubes run in parallel. Multiple tubes may be bundled when concealed.

- b. Tubing shall be flame resistant, multiple polyethylene tubing in an extruded PVC protective sheath, or unsheathed polyethylene tubing in rigid metal, intermediate metal, or electrical metallic tubing conduit for areas where tubing is exposed. Tubing shall have barbed fittings and valves, and shall conform to the following: Burst pressure shall be 550 psi gage at 75 degrees F to 175 psi gage at 150 degrees F, minimum. Stress crack resistance in accordance with ASTM D 1693 shall be 200 hours, minimum. Tensile strength in accordance with ASTM D 638 shall be 2000 psi, minimum. Average density in accordance with ASTM D 792 shall be 920 kg/m<sup>3</sup>. Average flow rate in accordance with ASTM D 1238 shall be 0.30 decigram per minute.
- c. Plastic tubing shall have the burning characteristics of linear low density polyethylene tubing, shall be self extinguishing when tested in accordance with ASTM D 635, shall have UL 94 V-2 flammability classification, and shall withstand stress cracking when tested in accordance with ASTM D 1693. Polyethylene tubing shall not be used for smoke removal systems.

### 2.3.3 Barrier Jacket

Plastic tubing bundles shall be provided with mylar barrier and flame retardant polyethylene jacket. Each tube shall be numbered.

## 2.4 PROGRAMMABLE LOGIC CONTROLLER (PLC)

### 2.4.1 PLC General Requirements

PLCs shall be micro-processor based, capable of receiving discrete and analog inputs and, through programming, shall be able to control discrete and analog output functions, perform data handling operations and communicate with external devices. PLCs shall meet the requirements of Class A computing devices, and shall be labeled as set forth in 47 CFR 15 and shall be able to withstand conducted susceptibility test as outlined in NEMA ICS 1, NEMA ICS 2, NEMA ICS 3, and or ANSI C37.90.1. PLCs shall function properly at temperatures between 32 and 122 degrees F at 5 to 95 percent relative humidity non-condensing and shall tolerate storage temperatures between minus 40 and plus 140 degrees F at 5 to 95 percent relative humidity non-condensing.

### 2.4.2 Modular PLC

PLCs shall be based on a modular, field expandable design allowing the system to be tailored to the process control application. The system shall be expandable through the use of additional hardware and/or user software. As a minimum, the PLC shall include a mounting backplane, power supply module, central processing unit (CPU) module, communications module, and input/output (I/O) module. The modules shall be grouped together in a mounting rack or cabinet. The mounting rack backplane shall provide the communications mechanism to fully integrate the individual modules located within the rack. Modules shall plug directly into the backplane. The use of wire connectors between modules will not be allowed. The rack size shall be as needed to hold the equipment necessary while performing the

required control functions. The system configuration shall allow for the removal and/or installation of modules under power.

#### 2.4.2.1 Central Processing Unit (CPU) Module

The CPU module shall be a self contained, microprocessor based unit that provides time of day, scanning, application (ladder rung logic) program execution, storage of application programs, storage of numerical values related to the application process and logic, I/O bus traffic control, peripheral and external device communications and self diagnostics.

#### 2.4.2.2 Communications Module

The communications module shall allow peer-to-peer communication with other PLCs and shall allow the PLC to communicate with the central station, or workstation. The communication module shall utilize the manufacturer's standard communication architecture and protocol, ethernet architecture and protocol or a combination of these. The communication module shall allow programming of the PLC to be done locally through the use of a laptop computer.

#### 2.4.2.3 Power Supply Module

One or more power supply modules shall be provided as necessary to power other modules installed in the same cabinet. Power supply modules shall plug directly into the backplane. Auxiliary power supplies may be used to supply power to remote cabinets or modules.

- a. Power supply modules shall use AC power with a nominal voltage of 120 vAc plus or minus 5 percent. The power supply module shall monitor the incoming line voltage level and shall provide over current and over voltage protection. If the voltage level is detected as being out of range the power supply module shall continue to provide power for an adequate amount of time to allow for a safe and orderly shutdown. Power supply modules shall be capable of withstanding a power loss for a minimum of 20 milliseconds while still remaining in operation and providing adequate power to all connected modules.
- b. Each power supply module shall be provided with an on-off switch integral to the module. If the manufacturer's standard power supply module is not provided with an on-off switch, a miniature toggle type switch shall be installed near the PLC and shall be clearly labeled as to its function.
- c. Power supply modules shall be provided with an indicating light which shall be lit when the module is operating properly.

#### 2.4.2.4 Input/Output (I/O) Modules

Modules shall be self contained, microprocessor based units that provide an interface to field devices. The module shall be located in the same mounting rack as the other PLC components. The unit shall plug directly into the backplane of the mounting rack. Each module shall contain visual indication to display the on-off status of individual inputs or outputs.

#### 2.4.3 Loop PLC

PLCs shall be single or multiple loop controllers depending on the control

system requirements. Controllers shall be self contained and shall include a central processing unit (CPU), program memory, power supply, input/output capability, network communications capability and display/keyboard. The controller shall have a scaleable process variable for each loop. Analog input signals shall be based on the use of proportional, integral and derivative (PID) control logic. Analog outputs shall be configured as direct acting or reverse acting. The controller shall have keyboard, display, auto/manual selection for control of each loop output, remote setpoint, adjustment/local setpoint adjustment selection with adjustable high-end and low-end limits, ratio and bias adjustment on remote setpoint input, operator-initiated self-tune/manual-tune selection and anti-reset wind-up feature. Controller shall power analog output loops to 20 mA<sub>dc</sub> when connected to a load of 600 ohms.

#### 2.4.3.1 Central Processing Unit (CPU)

The central processing unit shall be microprocessor based and shall provide time of day, scanning, application program (ladder rung logic) execution, storage of application programs, storage of numerical values related to the applications process and logic, I/O bus traffic control, peripheral and external device communications and self diagnostics.

#### 2.4.3.2 Power Requirements

Each controller shall be powered by 120 vAc. Power consumption shall not exceed 25 watts. Controller shall provide electrical noise isolation between the AC power line and the process variable inputs, remote setpoint inputs and output signals of not less than 100 dB at 60 Hertz common mode rejection ration and not less than 60 dB at 60 hertz normal-mode rejection ration.

#### 2.4.3.3 On-Off Switch

Each controller shall be provided with an integral on-off switch. If the controller is not provided with a manufacturers standard on-off switch, a miniature toggle type switch shall be installed near the controller and shall be clearly labeled as to its function.

#### 2.4.3.4 Parameter Input and Display

Control parameters shall be entered and displayed directly, in the correct engineering units, through a series of keystrokes on a front panel display with decimal point and polarity indication. Display shall be in English units.

#### 2.4.3.5 Self Tuning

Controllers shall be provided with self-tuning operation which shall apply to proportional, integral and derivative modes of control and shall modify the mode constants as required. Self-tuning shall only be in operation when selected from the front panel.

#### 2.4.4 Program Storage/Memory Requirements

The CPU shall utilize the manufacturer's standard non-volatile memory for the operating system. The controller shall have electronically erasable, programmable, read only memory (EEPROM) for storage of user programs and battery backed RAM for application memory. The EEPROM shall be loaded through the controller keypad, central station or through the use of a

laptop computer. The CPU memory capacity shall be based on the system's control requirements. The memory capacity shall be sized such that, when the system is completely programmed and functional, no more than 50 percent of the memory allocated for these purposes is used.

#### 2.4.5 Input/Output Characteristics

Each controller shall allow for analog input, analog output, discrete input and discrete output. The number and type of inputs and outputs for the system shall be as indicated on the drawings and shall comply with the sequence of control. The system capacity shall include a minimum of 20 percent spare input and output points (no less than two points) for each point type provided. During normal operation, a malfunction in any input/output channel shall affect the operation of that channel only and shall not affect the operation of the CPU or any other channel. Analog input circuits shall be available in 4-20 mA. Discrete input circuits shall be available in 10-30 vDc. All input circuits shall have a minimum optical isolation of 1500 VRMS and shall be filtered to guard against high voltage transients from the externally connected devices. Analog output circuits shall be available in 4-20 mA. Discrete output circuits shall be available in 10-30 vDc. All output circuits shall have a minimum optical isolation of 1500 VRMS and shall be filtered to guard against high voltage transients from the externally connected devices.

#### 2.4.6 Wiring Connections

Wiring connections shall be heavy duty, self lifting, pressure type screw terminals to provide easy wire insertion and secure connections. The terminals shall accept two #14 AWG wires. A hinged protective cover shall be provided over the wiring connections. The cover shall have write-on areas for identification of the external circuits.

#### 2.4.7 On-Off Switch

Each controller shall be provided with an integral on-off power switch. If the controller is not provided with a manufacturer's standard on-off switch, a miniature toggle type switch shall be installed in the control panel near the controller and shall be clearly labeled as to its function.

#### 2.4.8 Diagnostics

Each PLC shall have diagnostic routines implemented in firmware. The CPU shall continuously perform self-diagnostic routines that will provide information on the configuration and status of the CPU, memory, communications and input/output. The diagnostic routines shall be regularly performed during normal system operation. A portion of the scan time of the controller shall be dedicated to performing these housekeeping functions. In addition, a more extensive diagnostic routine shall be performed at power up and during normal system shutdown. The CPU shall log input/output and system faults in fault tables which shall be accessible for display. When a fault affects input/output or communications modules the CPU shall shut down only the hardware affected and continue operation by utilizing the healthy system components. All faults shall be annunciated at the PLC and the central work station. Diagnostic software shall be useable in conjunction with the portable tester.

#### 2.4.9 Accuracy

Controllers shall have an accuracy of plus or minus 0.25 percent of input

span.

## 2.5 PLC SOFTWARE

All PLC software described in this specification shall be furnished as part of the complete control system.

### 2.5.1 Operating System

Each PLC shall be provided with the manufacturer's standard operating system software package. The PLC shall maintain a point database in its memory that includes all parameters, constraints and the latest value or status of all points connected to the PLC. Execution of the PLC application programs shall use the data in memory resident files. The operating system shall support a full compliment of process control functions. It shall be possible to define these functions using a mix of function blocks, ladder logic diagrams, sequential function charts and text programming. Programming methods and interactions shall be based on IEC 61131-3. A combination of the programming methods shall be possible within a single controller. The operating system shall allow loading of software locally or from the central station and data files from the portable tester. It shall also support data entry and diagnostics using an operator interface panel attached directly to the PLC. Each PLC shall be capable of operating in stand alone mode.

#### 2.5.1.1 Startup

The PLC shall have startup software that causes automatic commencement of operation without human intervention, including startup of all connected I/O functions. A PLC restart program based on detection of power failure at the PLC shall be included in the PLC software. The restart program shall include start time delays between successive commands to prevent demand surges or overload trips.

#### 2.5.1.2 Failure Mode

Upon failure for any reason, each PLC shall perform an orderly shutdown and force all PLC outputs to a predetermined (failure mode) state, consistent with the failure modes shown and the associated control device.

### 2.5.2 Functions

The controller operating system shall be able to scan inputs, control outputs, and read and write to its internal memory in order to perform the required control as indicated in the sequence of control on the drawings. The controller shall periodically perform self diagnostics to verify that it is functioning properly.

#### 2.5.2.1 Analog Monitoring

The system shall measure and transmit all analog values including calculated analog points.

#### 2.5.2.2 Logic (Virtual)

Logic (virtual) points shall be software points entered in the point database which are not directly associated with a physical I/O function. Logic (virtual) points shall be analog or digital points created by calculation from any combination of digital and analog points, or other

data having all the properties of real points, including alarms, without the associated hardware. Logic (virtual) points shall be defined or calculated and entered into the database by the Contractor. The calculated analog point shall have point identification in the same format as any other analog point.

#### 2.5.2.3 State Variables

If an analog point represents more than two (up to 8) specific states, each state shall be nameable. For example, a level sensor shall be displayed at its measured engineering units plus a state variable with named states usable in programs or for display such as low alarm/low/normal/high/high alarm.

#### 2.5.2.4 Analog Totalization

Any analog point shall be operator assignable to the totalization program. Up to eight analog values shall be totalized within a selectable time period.

#### 2.5.2.5 Trending

Any analog or calculated point shall be operator assignable to the trend program. Up to eight points shall be sampled at individually assigned intervals, selectable between 1 minute and 2 hours. A minimum of the most recent 128 samples of each trended point shall be stored. The sample intervals shall be able to be defined, modified, or deleted online.

#### 2.5.3 Alarm Processing

Each PLC shall have alarm processing software for AI, DI, and PA alarms for all real and virtual points connected to that PLC.

##### 2.5.3.1 Digital Alarms

Digital alarms are those abnormal conditions indicated by DIs as specified and shown. The system shall automatically suppress analog alarm reporting associated with a digital point when that point is turned off.

##### 2.5.3.2 Analog Alarms

Analog alarms are those conditions higher or lower than a defined value, as measured by an AI. Analog readings shall be compared to predefined high and low limits, and alarmed each time a value enters or returns from a limit condition. Unique high and low limits shall be assigned to each analog point in the system. In control point adjustment (CPA) applications, key the limit to a finite deviation traveling with the setpoint. The system shall automatically suppress analog alarm reporting associated with an analog point when that analog point is turned off.

##### 2.5.3.3 Pulse Accumulator (PA) Alarms

Pulse accumulator alarms are those conditions calculated from totalized values of accumulator inputs or PA input rates that are outside defined limits as specified and shown. PA totalized values shall be compared to predefined limits and alarmed each time a value enters a limit condition. Unique limits shall be assigned to each PA point in the system.

#### 2.5.4 Constraints

#### 2.5.4.1 Equipment Constraints Definitions

Each control point in the database shall have PLC resident constraints defined and entered by the Contractor, including as applicable: maximum starts (cycles) per hour; minimum off time; minimum on time; high limit (value in engineering units); and low limit (value in engineering units).

#### 2.5.4.2 Constraints Checks

All control devices connected to the system shall have the PLC constraints checked and passed before each command is issued. Each command point shall have unique constraints assigned. High and low "reasonableness" values or one differential "rate-of-change" value shall be assigned to each AI. Each individual point shall be capable of being selectively disabled by the operator from the central station.

#### 2.5.5 Control Sequences and Control Loops

Specific functions to be implemented are defined in individual system control sequences and descriptions shown on the drawings, and shall include, as applicable, the following functions: PI control shall provide proportional control and proportional plus integral control; two position control shall provide control for a two state device by comparing a set point against a process variable and an established dead band; floating point control shall exercise control when an error signal exceeds a selected dead band, and shall maintain control until the error is within the dead band limits; signal selection shall allow the selection of the highest or lowest analog value from a group of analog values as the basis of control and shall include the ability to cascade analog values so that large numbers of inputs can be reduced to one or two outputs; signal averaging shall allow the mathematical calculation of the average analog value from a group of analog values as the basis of control and shall include the ability to "weight" the individual analog values so that the function output can be biased as necessary to achieve proper control; reset function shall develop an AO based on up to two AIs and one operator specified reset schedule.

#### 2.5.6 Command Priorities

A scheme of priority levels shall be provided to prevent interaction of a command of low priority with a command of higher priority. Override commands entered by the operator shall have higher priority than those emanating from applications programs.

#### 2.5.7 Resident Application Software

The Contractor shall provide resident applications programs developed in accordance with paragraph Graphical Object Oriented Programming to achieve the sequences of operation, parameters, constraints, and interlocks necessary to provide control of the process systems connected to the control system. All application programs shall be resident in the PLC and shall execute in the PLC, and shall coordinate with each other, to insure that no conflicts or contentions remain unresolved.

##### 2.5.7.1 Program Inputs and Outputs

The Contractor shall use program inputs listed for each application program to calculate the required program outputs. Where specific program inputs

are not available, a "default" value or virtual point appropriate for the equipment being controlled and the proposed sequence of operation shall be provided to replace the missing input, thus allowing the application program to operate.

#### 2.5.7.2 Failure Mode

In the event of a PLC failure, the controlled equipment shall continue to function in the failure mode indicated on the drawings.

### 2.6 CONTROL PANELS

#### 2.6.1 Components

##### 2.6.1.1 Enclosures

The enclosure for each control panel shall conform to the requirements of NEMA 250 for the types specified. Finish color shall be the manufacturer's standard, unless otherwise indicated. Damaged surfaces shall be repaired and refinished using original type finish. Enclosures for installation in mechanical equipment rooms shall be as defined in individual specification sections; those for installation in clean, dry indoor occupied space may be Type 1; other locations shall be as otherwise specified or shown. Enclosures for equipment installed outdoors shall be Type 4 or as shown. Enclosures for installation in a corrosive environment shall be Type 4X. Painted steel shall not be allowed for use in a corrosive environment. Enclosure shall be provided with a single, continuously hinged exterior door with print pocket, 3-point latching mechanism and key lock and a single, continuously hinged interior door.

##### 2.6.1.2 Controllers

Controllers shall be in accordance with paragraph Programmable Logic Controller (PLC).

##### 2.6.1.3 Standard Indicator Light

Indicator lights shall comply with NEMA ICS 1, NEMA ICS 2 and UL 508. Lights shall be heavy duty, round and shall mount in a 0.875 inch mounting hole. Indicator lights shall be LED type and shall operate at 120 vAc or 24 vDc. Long life bulbs shall be used. Indicator light shall be provided with a legend plate labeled as shown on the drawings. Lens color shall be per industry standard. Lights shall be push to test (lamp) type.

##### 2.6.1.4 Selector Switches

Selector switches shall comply with NEMA ICS 1, NEMA ICS 2 and UL 508. Selector switches shall be heavy duty, round and shall mount in a 0.875 inch mounting hole. The number of positions shall be as indicated on the drawings or as appropriate for the application. Switches shall be illuminated. Switches shall be rated for 600 volts, 10 amperes continuous. Selector switches shall be provided with a legend plate labeled as shown on the drawings or as directed. Where indicated or required, dual auxiliary contacts shall be provided for the automatic position to provide position sensing at the central station or workstation. Auxiliary contacts shall be rated for 120 vAc, 1A as a minimum. Where indicated on the drawings, switches shall be key operated. All keys shall be identical.

##### 2.6.1.5 Push Buttons

Push buttons shall comply with NEMA ICS 1, NEMA ICS 2 and UL 508. Push buttons shall be heavy duty, round and shall mount in a 0.875 inch mounting hole. The number and type of contacts shall be as indicated on the drawings or required by the Sequence of Control. Push buttons shall be rated for 600 volts, 10 amperes continuous. Each push button shall be provided with a legend plate labeled as required to indicate its function unless otherwise directed or otherwise required on the drawings.

#### 2.6.1.6 Relays

Relays shall comply with ANSI C37.90. Power consumption shall not be greater than 3 watts.

#### 2.6.1.7 Terminal Blocks

Terminal blocks shall comply with NEMA ICS 4 and UL 1059. Terminal blocks for conductors exiting control panels shall be two-way type with double terminals, one for internal wiring connections and the other for external wiring connections. Terminal blocks shall be made of bakelite or other suitable insulating material with full deep barriers between each pair of terminals. A terminal identification strip shall form part of the terminal block and each terminal shall be identified by a number in accordance with the numbering scheme on the approved wiring diagrams.

#### 2.6.1.8 Event Recorders

Recorder shall be provided with 16 channels for input of data and assignable alarm relay contacts. Engineering units, scaling factor and alarm limits shall be assignable to each channel. The recorder shall have a slow chart speed for normal operation and a faster speed for alarm conditions. The recorder will automatically operate at the faster speed when one or more channels exceed their high or low alarm setting. The date and time shall be printed when the alarm condition begins and when the alarm condition has cleared. The recorder shall automatically return to the normal speed when the alarm has cleared. The recorder normal speed shall be selectable from 0.01 to 120 inches/hour in increments of 0.01 inch/hour. The recorder shall have an accuracy of plus or minus 1 percent of full scale input for each channel. Recorder shall operate using 120 vAc electrical power and shall operate in a temperature range of 32 to 115 degrees F.

#### 2.6.1.9 Alarm Horns

Alarm horns shall be provided where indicated on the drawings. Horns shall be vibrating type and shall comply with UL 508. Horns shall provide 85 dB at 10 feet.

#### 2.6.2 Panel Assembly

Control panels shall be factory assembled and shipped to the jobsite as a single unit. Panels shall be fabricated as indicated and devices shall be mounted as shown or required. Each panel shall be fabricated as a bottom-entry connection point for control system electrical power, control system wiring, communications system wiring to other control panels.

#### 2.6.3 Electrical Requirements

Each panel shall be powered by a dedicated 120 volts ac circuit, with a

fuse, sized as recommended by the equipment manufacturer, and a disconnect switch located inside the panel. Wiring shall terminate inside the panel on terminal blocks. Electrical work shall be as specified in Section 16415A ELECTRICAL WORK, INTERIOR and as shown on the drawings.

#### 2.6.4 Power Line Conditioner

Each control panel shall be provided with a power line conditioner to provide both voltage regulation and noise rejection. The power line conditioner shall be of the ferro-resonant design, with no moving parts and no tap switching, while electrically isolating the secondary from the power line side. The power line conditioner shall be sized for 125 percent of the actual connected kva load. Characteristics of the power line conditioner shall be as follows:

##### 2.6.4.1 85 Percent Load

At 85 percent load, the output voltage shall not deviate by more than plus or minus 1 percent of nominal voltage when the input voltage fluctuates between minus 20 percent to plus 10 percent of nominal voltage.

##### 2.6.4.2 Load Changes

During load changes of zero to full load, the output voltage shall not deviate by more than plus or minus 3 percent of nominal voltage. Full correction of load switching disturbances shall be accomplished within 5 cycles, and 95 percent correction shall be accomplished within 2 cycles of the onset of the disturbance.

#### 2.6.5 Grounding

Control panel enclosures shall be equipped with a solid copper ground bus or equivalent. The ground bus shall be securely anchored to the enclosure so as to effectively ground the entire structure. Clamp-type terminals sized large enough to carry the maximum expected current shall be provided on the ground bus for grounding cables. Where a definite circuit ground is required, a single wire not less than #10 AWG shall run independently to the panel ground bus and shall be fastened to the ground bus with a bolted terminal lug. Cases of instruments, relays and other devices shall be effectively grounded through the enclosures steel structure unless otherwise indicated. Insulated wiring having a continuous rated current of not less than the circuit fuse rating shall be used for grounding. Grounding terminals of power receptacles shall be solidly grounded to the panel enclosure.

#### 2.6.6 Panel Interior Light

Each control panel shall be provided with a 40 watt fluorescent light. The light shall be operated by a manual on-off switch mounted on the interior door of the enclosure.

### PART 3 EXECUTION

#### 3.1 EQUIPMENT INSTALLATION REQUIREMENTS

##### 3.1.1 Installation

The Contractor shall install system components and appurtenances in accordance with the manufacturer's instructions and shall provide necessary

interconnections, services, and adjustments required for a complete and operable system. Instrumentation and communication equipment and cable grounding shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation. The Contractor shall adjust or replace devices not conforming to the required accuracies. Factory sealed devices shall be replaced (rather than adjusted). Wiring in exposed areas, including low voltage wiring, shall be installed in metallic raceways or EMT conduit as specified in Section 16415A ELECTRICAL WORK, INTERIOR. Wiring in air plenum areas installed without conduit shall be plenum-rated per NFPA 70.

#### 3.1.1.1 Isolation, Penetrations of Buildings and Clearance from Equipment

Dielectric isolation shall be provided where dissimilar metals are used for connection and support. Penetrations through and mounting holes in the building exteriors shall be made watertight. Holes in concrete, brick, steel and wood walls shall be drilled or core drilled with proper equipment; conduits installed through openings shall be sealed with materials which are compatible with existing materials. Openings shall be sealed with materials which meet the requirements of NFPA 70 and Section 07840A FIRESTOPPING. Installation shall provide clearance for control-system maintenance. Control system installation shall not interfere with the clearance requirements for mechanical and electrical system maintenance.

#### 3.1.1.2 Device Mounting

Devices shall be installed in accordance with manufacturers' recommendations and as shown. Control devices to be installed in piping shall be provided with required gaskets, flanges, thermal compounds, insulation, piping, fittings, and manual valves for shutoff, equalization, purging, and calibration. Any deviations shall be documented by the Contractor and submitted to the Government for approval prior to mounting.

Damaged insulation shall be replaced or repaired after devices are installed to match existing work. Damaged galvanized surfaces shall be repaired by touching up with zinc paint.

#### 3.1.1.3 Pneumatic Tubing

Tubing shall be concealed in finished areas. Tubing may be run exposed in unfinished areas, such as mechanical equipment rooms. For tubing to be enclosed in concrete, rigid metal or intermediate metal conduit shall be provided. Tubing shall be installed parallel or perpendicular to building walls throughout. Maximum spacing between tubing supports shall be 5 feet.

Each tubing system shall be tested pneumatically at 1.5 times the working pressure for 24 hours, with a maximum pressure drop of 1.0 psig with compressed air supply turned off. Joint leaks shall be corrected by remaking the joint. Caulking of joints will not be permitted. Tubing and two insulated copper phone wires for installation checkout may be run in the same conduit. Tubing and electrical power conductors shall not be run in the same conduit; however, control circuit conductors may be run in the same conduit as polyethylene tubing.

#### 3.1.1.4 Grooved Mechanical Joints

Grooves shall be prepared according to the coupling manufacturer's instructions. Grooved fittings, couplings, and grooving tools shall be the products of the same manufacturer. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter

of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded.

### 3.1.2 Sequences of Operation

The Contractor shall study the operation and sequence of local equipment controls, as a part of the conditions report, and note any deviations from the described sequences of operation on the contract drawings. The Contractor shall make necessary adjustments to make the equipment operate in an optimum manner and shall fully document changes made.

## 3.2 INSTALLATION OF EQUIPMENT

The Contractor shall install equipment as specified, as shown and as required in the manufacturer's instructions for a complete and fully operational control system.

### 3.2.1 Control Panels

Control panels shall be located as indicated on the drawings. Devices located in the control panels shall be as shown on the drawings or as needed to provide the indicated control sequences.

### 3.2.2 Flow Measuring Device

#### 3.2.2.1 Flow Switch

Flow switches shall be installed in such a manner as to minimize disturbance of the flow of fluid while maintaining reliable operation of the switch.

### 3.2.3 Level Instruments

#### 3.2.3.1 Ultrasonic Sensor

Sensor shall be installed vertically in the top of the tank and in accordance with the manufacturer's instructions. Switches shall be accessible for maintenance and calibration. In applications where switches cannot be directly mounted to a tank by the threaded or flanged connection, a mounting bracket shall be provided for connection to the inside tank wall. Sensor shall be positioned to maximize the return echo signal and minimize vessel obstructions in the sensors line of sight. The minimum recommended distance from the tank fill opening and from the side of the tank shall be maintained. Stand pipes for level sensors shall be provided as recommended by the manufacturer or as required to eliminate erroneous readings.

### 3.2.4 Pressure Instruments

Pressure sensors and pressure transducers shall be verified by calibration. All pressure taps shall incorporate appropriate snubbers. Pressure sensors and pressure switches shall have valves for isolation, venting, and taps for calibration. Pressure switches and pressure transducers installed on liquid or steam lines shall have drains. Pressure transducers, differential pressure sensors and differential pressure switches shall have nulling valves. Pressure switches shall be adjusted to the proper setpoint

and shall be verified by calibration. Switch contact ratings and duty shall be selected for the application.

### 3.2.5 Temperature Instrument Installation

#### 3.2.5.1 RTD

When the RTD is installed in pipe or is susceptible to corrosion or vibration, the RTD shall be installed in a thermowell. Thermowells shall be filled with conductive heat transfer fluid prior to installation of the RTD in the thermowell. RTDs used for space temperature sensing shall include a housing suitable for wall mounting. RTDs used for outside air sensing shall have an instrument shelter or sun shield as shown to minimize solar effects, and shall be mounted to minimize building effects. RTD assemblies shall be readily accessible and installed to allow easy replacement.

#### 3.2.5.2 Temperature Switches

Temperature switches shall be installed as specified for RTDs. Temperature switches shall be adjusted to the proper setpoint and shall be verified by calibration. Switch contact ratings and duty shall be selected for the application.

#### 3.2.5.3 Thermometers and Temperature Sensing Elements

Thermometers and temperature sensing elements installed in liquid systems shall be installed in thermowells.

#### 3.2.6 Auto-Dialers

System auto-dialers shall be installed as defined on sheet E5.02.

#### 3.2.7 Instrument Shelters

Instrument shelters shall be installed in the location shown with the bottom 4.0 feet above the supporting surface using legs and secured rigidly to minimize vibrations from winds. Instrument shelters shall be oriented with door facing North. Instruments located in shelters shall be mounted in the 3-dimensional center of the open space of the shelter.

#### 3.2.8 Electric Power Devices

##### 3.2.8.1 Potential and Current Transformers

The Contractor shall install potential and current transformers in enclosures unless otherwise shown. Current transformer leads shall be shorted when they are not connected to the measurement circuits.

##### 3.2.8.2 Transducers

Transducers shall be wired in accordance with the manufacturer's instructions, and installed in enclosures.

##### 3.2.8.3 Current Sensing Relays and Current Transducers for Motors

When used to sense meter/fan/pump status, current sensing relays shall be used for applications under 5 hp. Applications over 5 hp shall use a current transducer.

### 3.2.9 Output Devices

Output devices (transducers, relays, contactors, or other devices) which are not an integral part of the control panel, shall be mounted in an enclosure mounted adjacent to the control panel, unless otherwise shown. Where H-O-A and/or override switches on the drawings or required by the control sequence, the switches shall be installed so that the control system controls the function through the automatic position and other controls work through the hand position.

### 3.2.10 Enclosures

All enclosure penetrations shall be from the bottom of the enclosure, and shall be sealed to preclude entry of water using a silicone rubber sealant.

### 3.2.11 Transformers

Transformers for control voltages below 120 vAc shall be fed from the nearest power panel or motor control center, using circuits provided for the purpose. The Contractor shall provide a disconnect switch on the primary side and a fuse on the secondary side. Transformers shall be enclosed in a steel cabinet with conduit connections.

## 3.3 WIRE, CABLE AND CONNECTING HARDWARE

### 3.3.1 Sensor Wiring

Ssensor wiring shall be installed in accordance with the requirements of ANSI C12.1, NFPA 70, Section 16375A ELECTRICAL DISTRIBUTION, UNDERGROUND and Section 16415A ELECTRICAL WORK, INTERIOR.

#### 3.3.1.1 Power Line Surge Protection

Control panels shall be protected from power line surges. Protection shall meet the requirements of IEEE C62.41. Fuses shall not be used for surge protection.

#### 3.3.1.2 Sensor and Control Wiring Surge Protection

Digital and analog inputs shall be protected against surges induced on control and sensor wiring. Digital and analog outputs shall be protected against surges induced on control and sensor wiring installed outdoors and as shown. Fuses shall not be used for surge protection. The inputs and outputs shall be tested in both the normal and common mode using the following two waveforms: The first waveform shall be 10 microseconds by 1000 microseconds with a peak voltage of 1500 volts and a peak current of 60 amperes. The second waveform shall be 8 microseconds by 20 microseconds with a peak voltage of 1000 volts and a peak current of 500 amperes.

## 3.4 FIELD TESTING AND ADJUSTING EQUIPMENT

The Contractor shall provide personnel, equipment, instrumentation, and supplies necessary to perform site testing. The Government will witness the PVT, and written permission shall be obtained from the Government before proceeding with the testing. Original copies of data produced, including results of each test procedure, during PVT shall be turned over to the Government at the conclusion of each phase of testing prior to Government approval of the test. The test procedures shall cover actual

equipment and functions specified for the project.

#### 3.4.1 Testing, Adjusting and Commissioning

After successful completion of the factory test as specified, the Contractor will be authorized to proceed with the installation of the system equipment, hardware, and software. Once the installation has been completed, the Contractor shall test, adjust, and commission each control loop and system in accordance with NIST SP 250 and shall verify proper operation of each item in the sequences of operation, including hardware and software. The Contractor shall calibrate field equipment, including control devices, adjust control parameters and logic (virtual) points including control loop setpoints, gain constants, constraints, and verify data communications before the system is placed online. Ground rods installed by the Contractor shall be tested as specified in IEEE Std 142. The Contractor shall calibrate each instrumentation device connected to the control system control network by making a comparison between the reading at the device and the display at the workstation, using a standard at least twice as accurate as the device to be calibrated. The Contractor shall check each control point within the control system control network by making a comparison between the control command at the central station and field-controlled device. The Contractor shall deliver trend logs/graphs of all points showing to the Government that stable control has been achieved.

Points on common systems shall be trended simultaneously. One log shall be provided showing concurrent samples taken once a minute for a total of 4 hours. One log shall be provided showing concurrent samples taken once every 30 minutes, for a total of 24 hours. The Contractor shall verify operation of systems in the specified failure modes upon Control system network failure or loss of power, and verify that systems return to control system control automatically upon a resumption of control system network operation or return of power. The Contractor shall deliver a report describing results of functional tests, diagnostics, calibrations and commissioning procedures including written certification to the Government that the installed complete system has been calibrated, tested, adjusted and commissioned and is ready to begin the PVT. The report shall also include a copy of the approved PVT procedure.

#### 3.4.2 Performance Verification Test (PVT)

The Contractor shall prepare test procedures for the PVT. The test procedure shall describe all tests to be performed and other pertinent information such as specialized test equipment required and the length of the PVT. The test procedures shall explain, in detail, step-by-step actions and the expected results, to demonstrate compliance with all the requirements of the drawings and this specification. The test procedure shall be site specific and based on the inputs and outputs, required calculated points and the sequence of control. The Contractor shall demonstrate that the completed Control system complies with the contract requirements. All physical and functional requirements of the project including communication requirements shall be demonstrated and shown. The Contractor shall demonstrate that each system operates as required in the sequence of operation. The PVT as specified shall not be started until after receipt by the Contractor of written permission by the Government, based on the Contractor's written report including certification of successful completion of testing, adjusting and commissioning as specified, and upon successful completion of training as specified. Upon successful completion of the PVT, the Contractor shall deliver test reports and other documentation as specified to the Government.

### 3.4.3 Endurance Test

The Contractor shall use the endurance test to demonstrate the overall system reliability of the completed system. The endurance test shall be conducted in phases. The endurance test shall not be started until the Government notifies the Contractor in writing that the PVT is satisfactorily completed, training as specified has been completed, outstanding deficiencies have been satisfactorily corrected, and that the Contractor has permission to start the endurance test. The Contractor shall provide an operator to man the system 8 hours per day during daytime operations, including weekends and holidays, during Phase I endurance testing, in addition to any Government personnel that may be made available. The Government may terminate testing at any time when the system fails to perform as specified. Upon termination of testing by the Government or by the Contractor, the Contractor shall commence an assessment period as described for Phase II. Upon successful completion of the endurance test, the Contractor shall deliver test reports and other documentation, as specified, to the Government prior to acceptance of the system.

#### 3.4.3.1 Phase I (Testing)

The test shall be conducted 24 hours per day, for 5 consecutive calendar days, including holidays, and the system shall operate as specified. The Contractor shall make no repairs during this phase of testing unless authorized by the Government in writing.

#### 3.4.3.2 Phase II (Assessment)

After the conclusion of Phase I, the Contractor shall identify failures, determine causes of failures, repair failures, and deliver a written report to the Government. The report shall explain in detail the nature of each failure, corrective action taken, results of tests performed, and shall recommend the point at which testing should be resumed. After delivering the written report, the Contractor shall convene a test review meeting at the job site to present the results and recommendations to the Government. The meeting shall not be scheduled earlier than 5 business days after receipt of the report by the Government. As a part of this test review meeting, the Contractor shall demonstrate that failures have been corrected by performing appropriate portions of the performance verification test. The Government reserves the right to cancel the test review meeting if no failures or deficiencies occur during the Phase I testing. If the Government chooses to do so, the Contractor will be notified in writing. Based on the Contractor's report and the test review meeting, the Government will determine if retesting is necessary and the restart point. The Government reserves the right to require that the Phase I test be totally or partially rerun. The Contractor shall not commence any required retesting until after receipt of written notification by the Government. After the conclusion of any retesting which the Government may require, the Phase II assessment shall be repeated as if Phase I had just been completed.

#### 3.4.3.3 Exclusions

The Contractor will not be held responsible for failures resulting from the following: Outage of the main power supply in excess of the capability of any backup power source, provided that the automatic initiation of all backup sources was accomplished and that automatic shutdown and restart of the control system performed as specified. Failure of a Government furnished communications link, provided that the PLC automatically and

correctly operates in the stand-alone mode as specified, and that the failure was not due to Contractor furnished equipment, installation, or software. Failure of existing Government owned equipment, provided that the failure was not due to Contractor furnished equipment, installation, or software.

### 3.5 MANUFACTURER'S FIELD SERVICES

The Contractor shall obtain the services of a manufacturer's representative experienced in the installation, adjustment, and operation of the equipment specified. The representative shall supervise the installing, adjusting, and testing of the equipment.

### 3.6 INSTRUMENTATION AND CONTROL SYSTEM

Control drawings, framed, non-fading half-size in laminated plastic, shall be provided for equipment furnished and for interfaces to equipment at each respective equipment location. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation and procedures for safely starting and stopping the system manually shall be prepared in typed form, framed as specified for the instrumentation and control diagrams and posted beside the diagrams. Diagrams and instructions shall be submitted prior to posting.

### 3.7 FIELD TRAINING

Field training oriented to the specific system shall be provided for designated personnel. A copy of the training manual for each trainee plus two additional copies shall be delivered to the Contracting Officer. Manuals shall include an agenda, the defined objectives for each lesson, and a detailed description of the subject matter for each lesson. The Contractor shall furnish audiovisual equipment and other training supplies and materials. Copies of the audiovisuals shall be delivered with the printed training manuals. The Government reserves the right to videotape training sessions for later use. A training day is defined as 8 hours of classroom instruction, excluding lunchtime, Monday through Friday, during the daytime shift in effect at the training facility. Approval of the Contractor's training schedule shall be obtained from the Government at least 30 days before the training.

#### 3.7.1 Preliminary Operator Training

Prior to the start of field testing, preliminary operator training shall be taught at the project site for 2 consecutive training days. Upon completion of this course, each student, using appropriate documentation, should be able to perform elementary operations with guidance and describe the general hardware architecture and functionality of the system. This course shall include: general system architecture; functional operation of the system, including workstations; operator commands; application programs, control sequences, and control loops; database entry and modification; reports generation; alarm reporting; diagnostics; and historical files.

#### 3.7.2 Additional Operator Training

Following the field testing, additional classroom training for operators shall be taught for 2 consecutive training days; and an additional 1 day classroom session for answering operator questions. Individual instruction shall consist of "hands-on" training under the constant monitoring of the

instructor. Classroom training shall include instruction on the specific hardware configuration of the installed control system and specific instructions for operating the installed system. The Contractor shall schedule activities during this period so that the specified amount of time on the equipment will be available for each student. The final session will address specific topics that the students need to discuss and to answer questions concerning the operation of the system. Upon completion of the course, the students should be fully proficient in system operation and have no unanswered questions regarding operation of the installed control system. Each student should be able to start the system, operate the system, recover the system after a failure and describe the specific hardware architecture and operation of the system and be fully proficient in all system operations. The Contractor shall report the skill level of each student at the end of this course.

### 3.7.3 Maintenance Training

Following the endurance test, a minimum period of 2 training days shall be provided by a factory representative or a qualified Contractor trainer for ten designated personnel on maintenance of the equipment. The training shall include: physical layout of each piece of hardware, calibration procedures, preventive maintenance procedures, schedules, troubleshooting, diagnostic procedures and repair instructions.

### 3.7.4 Specialized Training

Following the maintenance training, a minimum period of one training day shall be provided by a factory representative or a qualified Contractor trainer for ten people on the input devices.

#### 3.7.4.1 Flow Meter Training

Each type of flow meter, to include calibration, maintenance and testing of flow elements and transducers.

#### 3.7.4.2 Specialized Sensor Training

Each type of specialized sensor is to include calibration, maintenance and testing of sensing elements and transducers.

-- End of Section --

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## SECTION 13851A

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## SECTION 13851A

FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE  
02/02

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI S3.41 (1990; R 1996) Audible Emergency  
Evacuation Signal

## INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41 (1991; R 1995) Surge Voltages in  
Low-Voltage AC Power Circuits

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

NFPA 72 (1999) National Fire Alarm Code

NFPA 90A (1999) Installation of Air Conditioning  
and Ventilating Systems

## UNDERWRITERS LABORATORIES (UL)

UL 1242 (1996; Rev Mar 1998) Intermediate Metal  
Conduit

UL 1971 (1995; Rev thru Apr 1999) Signaling  
Devices for the Hearing Impaired

UL 228 (1997; Rev Jan 1999) Door Closers-Holders,  
With or Without Integral Smoke Detectors

UL 268 (1996; Rev thru Jan 1999) Smoke Detectors  
for Fire Protective Signaling Systems

UL 268A (1998) Smoke Detectors for Duct Application

UL 38 (1999) Manually Actuated Signaling Boxes  
for Use with Fire-Protective Signaling  
Systems

UL 464 (1996; Rev thru May 1999) Audible Signal  
Appliances

UL 521 (1999) Heat Detectors for Fire Protective

## Signaling Systems

UL 6	(1997) Rigid Metal Conduit
UL 632	(2000) Electrically-Actuated Transmitters
UL 797	(1993; Rev thru Mar 1997) Electrical Metallic Tubing
UL 864	(1996; Rev thru Mar 1999) Control Units for Fire Protective Signaling Systems

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

## Fire Alarm Reporting System; G-DO

Detail drawings, prepared and signed by a Registered Professional Engineer or a NICET Level 3 Fire Alarm Technician, consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. Note that the contract drawings show layouts based on typical detectors. The Contractor shall check the layout based on the actual detectors to be installed and make any necessary revisions in the detail drawings. The detail drawings shall also contain complete wiring and schematic diagrams for the equipment furnished, equipment layout, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Detailed point-to-point wiring diagram shall be prepared and signed by a Registered Professional Engineer or a NICET Level 3 Fire Alarm Technician showing points of connection. Diagram shall include connections between system devices, appliances, control panels, supervised devices, and equipment that is activated or controlled by the panel.

## SD-03 Product Data

## Storage Batteries; G-DO

Substantiating battery calculations for supervisory and alarm power requirements. Ampere-hour requirements for each system component and each panel component, and the battery recharging period shall be included.

## Voltage Drop; G-DO

Voltage drop calculations for notification appliance circuits to indicate that sufficient voltage is available for proper appliance operation.

#### Special Tools and Spare Parts; G-AO

Spare parts data for each different item of material and equipment specified, not later than 3 months prior to the date of beneficial occupancy. Data shall include a complete list of parts and supplies with the current unit prices and source of supply and a list of the parts recommended by the manufacturer to be replaced after 1 year of service.

#### Technical Data and Computer Software; G-DO

Technical data which relates to computer software.

#### Training; G-AO

Lesson plans, operating instructions, maintenance procedures, and training data, furnished in manual format, for the training courses. The operations training shall familiarize designated government personnel with proper operation of the fire alarm system. The maintenance training course shall provide the designated government personnel adequate knowledge required to diagnose, repair, maintain, and expand functions inherent to the system.

#### Testing; G-AO

Detailed test procedures, prepared and signed by a Registered Professional Engineer or a NICET Level 3 Fire Alarm Technician, for the fire detection and alarm system 60 days prior to performing system tests.

#### SD-06 Test Reports

##### Testing; G-AO

Test reports, in booklet form, showing field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall document readings, test results and indicate the final position of controls. The Contractor shall include the NFPA 72 Certificate of Completion and NFPA 72 Inspection and Testing Form, with the appropriate test reports.

#### SD-07 Certificates

##### Equipment; G-DO

Certified copies of current approvals or listings issued by an independent test lab if not listed by UL, FM or other nationally recognized testing laboratory, showing compliance with specified NFPA standards.

##### Qualifications; G-DO

Proof of qualifications for required personnel. The installer shall submit proof of experience for the Professional Engineer, fire alarm technician, and the installing company.

## SD-10 Operation and Maintenance Data

## Technical Data and Computer Software; G-DO

Six copies of operating manual outlining step-by-step procedures required for system startup, operation, and shutdown. The manual shall include the manufacturer's name, model number, service manual, parts list, and complete description of equipment and their basic operating features. Six copies of maintenance manual listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The manuals shall include conduit layout, equipment layout and simplified wiring, and control diagrams of the system as installed. The manuals shall include complete procedures for system revision and expansion, detailing both equipment and software requirements. Original and backup copies of all software delivered for this project shall be provided, on each type of media utilized. Manuals shall be approved prior to training.

## 1.3 GENERAL REQUIREMENTS

## 1.3.1 Standard Products

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that can provide service within 24 hours of notification.

## 1.3.2 Nameplates

Major components of equipment shall have the manufacturer's name, address, type or style, voltage and current rating, and catalog number on a noncorrosive and nonheat-sensitive plate which is securely attached to the equipment.

## 1.3.3 Keys and Locks

Locks shall be keyed alike. Four keys for the system shall be provided.

## 1.3.4 Tags

Tags with stamped identification number shall be furnished for keys and locks.

## 1.3.5 Verification of Dimensions

After becoming familiar with details of the work, the Contractor shall verify dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing the work.

## 1.3.6 Compliance

The fire detection and alarm system and the central reporting system shall be configured in accordance with NFPA 72; exceptions are acceptable as directed by the Contracting Officer. The equipment furnished shall be compatible and be UL listed, FM approved, or approved or listed by a nationally recognized testing laboratory in accordance with the applicable NFPA standards.

### 1.3.7 Qualifications

#### 1.3.7.1 Engineer and Technician

a. Registered Professional Engineer with verification of experience and at least 4 years of current experience in the design of the fire protection and detection systems.

b. National Institute for Certification in Engineering Technologies (NICET) qualifications as an engineering technician in fire alarm systems program with verification of experience and current NICET certificate.

c. The Registered Professional Engineer may perform all required items under this specification. The NICET Fire Alarm Technician shall perform only the items allowed by the specific category of certification held.

#### 1.3.7.2 Installer

The installing Contractor shall provide the following: NICET Fire Alarm Technicians to perform the installation of the system. A NICET Level 3 Fire Alarm Technician shall supervise the installation of the fire alarm system. NICET Level 2 or higher Fire Alarm Technician shall install and terminate fire alarm devices, cabinets and panels. An electrician or NICET Level 1 Fire Alarm Technician shall install conduit for the fire alarm system. The Fire Alarm technicians installing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

#### 1.3.7.3 Design Services

Installations requiring designs or modifications of fire detection, fire alarm, or fire suppression systems shall require the services and review of a qualified fire protection engineer. For the purposes of meeting this requirement, a qualified fire protection engineer is defined as an individual meeting one of the following conditions:

- a. An engineer having a Bachelor of Science or Masters of Science Degree in Fire Protection Engineering from an accredited university engineering program, plus a minimum of 2 years' work experience in fire protection engineering.
- b. A registered professional engineer (P.E.) in fire protection engineering.
- c. A registered PE in a related engineering discipline and member grade status in the National Society of Fire Protection Engineers.
- d. An engineer with a minimum of 10 years' experience in fire protection engineering and member grade status in the National Society of Fire Protection Engineers.

### 1.4 SYSTEM DESIGN

#### 1.4.1 Operation

The fire alarm and detection system shall be a complete, supervised fire alarm reporting system. The system shall be activated into the alarm mode by actuation of any alarm initiating device. The system shall remain in

the alarm mode until the initiating device is reset and the fire alarm control panel is reset and restored to normal. Alarm initiating devices shall be connected to initiating device circuits (IDC), Class A, Style D, to signal line circuits (SLC), Class A, Style 6, in accordance with NFPA 72.

Alarm notification appliances shall be connected to notification appliance circuits (NAC), Style Z in accordance with NFPA 72. A looped conduit system shall be provided so that if the conduit and all conductors within are severed at any point, all IDC, NAC and SLC will remain functional. The conduit loop requirement is not applicable to the signal transmission link from the local panels at the protected premises to the Supervising Station (fire station, fire alarm central communication center). Textual, audible, and visual appliances and systems shall comply with NFPA 72. Fire alarm system components requiring power, except for the control panel power supply, shall operate on 24 Volts dc. Addressable system shall be microcomputer (microprocessor or microcontroller) based with a minimum word size of eight bits and shall provide the following features:

- a. Sufficient memory to perform as specified and as shown for addressable system.
- b. Individual identity of each addressable device for the following conditions: alarm; trouble; open; short; and appliances missing/failed remote detector - sensitivity adjustment from the panel for smoke detectors
- c. Capability of each addressable device being individually disabled or enabled from the panel.
- d. Each SLC shall be sized to provide 40 percent addressable expansion without hardware modifications to the panel.

#### 1.4.2 Operational Features

The system shall have the following operating features:

- a. Monitor electrical supervision of IDC, SLC, and NAC. Smoke detectors shall have combined alarm initiating and power circuits.
- b. Monitor electrical supervision of the primary power (ac) supply, battery voltage, placement of alarm zone module (card, PC board) within the control panel, and transmitter tripping circuit integrity.
- c. A trouble buzzer and trouble LED/LCD (light emitting diode/liquid crystal diode) to activate upon a single break, open, or ground fault condition which prevents the required normal operation of the system. The trouble signal shall also operate upon loss of primary power (ac) supply, low battery voltage, removal of alarm zone module (card, PC board), and disconnection of the circuit used for transmitting alarm signals off-premises. A trouble alarm silence switch shall be provided which will silence the trouble buzzer, but will not extinguish the trouble indicator LED/LCD. Subsequent trouble and supervisory alarms shall sound the trouble signal until silenced. After the system returns to normal operating conditions, the trouble buzzer shall again sound until the silencing switch returns to normal position, unless automatic trouble reset is provided.
- d. A one person test mode. Activating an initiating device in this

mode will activate an alarm for a short period of time, then automatically reset the alarm, without activating the transmitter during the entire process.

- e. A transmitter disconnect switch to allow testing and maintenance of the system without activating the auto-dialer but providing a trouble signal when disconnected and a restoration signal when reconnected.
- f. Evacuation alarm silencing switch which, when activated, will silence alarm devices, but will not affect the zone indicating LED/LCD nor the operation of the transmitter. This switch shall be over-ridden upon activation of a subsequent alarm from an unalarmed device and the NAC devices will be activated.
- g. Electrical supervision for circuits used for supervisory signal services (i.e., sprinkler systems, valves, etc.). Supervision shall detect any open, short, or ground.
- h. Confirmation or verification of all smoke detectors. The control panel shall interrupt the transmission of an alarm signal to the system control panel for a factory preset period. This interruption period shall be adjustable from 1 to 60 seconds and be factory set at 20 seconds. Immediately following the interruption period, a confirmation period shall be in effect during which time an alarm signal, if present, will be sent immediately to the control panel. Fire alarm devices other than smoke detectors shall be programmed without confirmation or verification.
- i. The fire alarm control panel shall provide supervised addressable relays for HVAC shutdown. An override at the HVAC panel shall not be provided.
- j. Provide one person test mode - Activating an initiating device in this mode will activate an alarm for a short period of time, then automatically reset the alarm, without activating the transmitter during the entire process.
- k. The fire alarm control panel shall provide the required monitoring and supervised control outputs needed to accomplish elevator recall.
- l. The fire alarm control panel shall monitor the fire sprinkler system, or other fire protection extinguishing system.
- m. The control panel and field panels shall be software reprogrammable to enable expansion or modification of the system without replacement of hardware or firmware. Examples of required changes are: adding or deleting devices or zones; changing system responses to particular input signals; programming certain input signals to activate auxiliary devices.
- n. Zones for IDC and NAC shall be arranged as indicated on the contract drawings.

#### 1.4.3 Alarm Functions

An alarm condition on a circuit shall automatically initiate the following

functions:

- a. Transmission of a signal over the station auto-dialer (telephonic) fire reporting system. The signals shall be as follows: trouble, supervisory and alarm.
- b. Visual indications of the alarmed devices on the fire alarm control panel display and on the remote audible/visual display.
- c. Continuous sounding or operation of alarm notification appliances throughout the building as required by ANSI S3.41.
- d. Closure of metal rolling counter doors held open by electromagnetic devices.
- e. Deactivation of the air handling units throughout the building.

#### 1.4.4 Primary Power

Operating power shall be provided as required by paragraph Power Supply for the System. Transfer from normal to emergency power or restoration from emergency to normal power shall be fully automatic and not cause transmission of a false alarm. Loss of ac power shall not prevent transmission of a signal via the fire reporting system upon operation of any initiating circuit.

#### 1.4.5 Battery Backup Power

Battery backup power shall be through use of rechargeable, sealed-type storage batteries and battery charger.

#### 1.4.6 Interface With other Equipment

Interfacing components shall be furnished as required to connect to subsystems or devices which interact with the fire alarm system.

### 1.5 TECHNICAL DATA AND COMPUTER SOFTWARE

Technical data and computer software (meaning technical data which relates to computer software) which is specifically identified in this project, and which may be defined/required in other specifications, shall be delivered, strictly in accordance with the CONTRACT CLAUSES, and in accordance with the Contract Data Requirements List, DD Form 1423. Data delivered shall be identified by reference to the particular specification paragraph against which it is furnished. Data to be submitted shall include complete system, equipment, and software descriptions. Descriptions shall show how the equipment will operate as a system to meet the performance requirements of this contract. The data package shall also include the following:

- (1) Identification of programmable portions of system equipment and capabilities.
- (2) Description of system revision and expansion capabilities and methods of implementation detailing both equipment and software requirements.
- (3) Provision of operational software data on all modes of programmable portions of the fire alarm and detection system.

- (4) Description of Fire Alarm Control Panel equipment operation.
- (5) Description of auxiliary and remote equipment operations.
- (6) Library of application software.
- (7) Operation and maintenance manuals as specified in SD-19 of the Submittals paragraph.

#### 1.6 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt, dust, and any other contaminants.

### PART 2 PRODUCTS

#### 2.1 CONTROL PANEL

Control Panel shall comply with the applicable requirements of UL 864. Panel shall be modular, installed in a surface mounted steel cabinet with hinged door and cylinder lock. Control panel shall be a clean, uncluttered, and orderly assembled panel containing components and equipment required to provide the specified operating and supervisory functions of the system. The panel shall have prominent rigid plastic, phenolic or metal identification plates for LED/LCDs, zones, SLC, controls, meters, fuses, and switches. Nameplates for fuses shall also include ampere rating. The LED/LCD displays shall be located on the exterior of the cabinet door or be visible through the cabinet door. Control panel switches shall be within the locked cabinet. A suitable means (single operation) shall be provided for testing the control panel visual indicating devices (meters or LEDs/LCDs). Meters and LEDs shall be plainly visible when the cabinet door is closed. Signals and LEDs/LCDs shall be provided to indicate by zone any alarm, supervisory or trouble condition on the system. Each IDC shall be powered and supervised so that a signal on one zone does not prevent the receipt of signals from other devices. Loss of power, including batteries, shall not require the manual reloading of a program. Upon restoration of power, startup shall be automatic, and shall not require any manual operation. The loss of primary power or the sequence of applying primary or emergency power shall not affect the transmission of alarm, supervisory or trouble signals. Visual annunciation shall be provided for LED/LCD visual display as an integral part of the control panel and shall identify with a word description and id number each device. Cabinets shall be provided with ample gutter space to allow proper clearance between the cabinet and live parts of the panel equipment. If more than one modular unit is required to form a control panel, the units shall be installed in a single cabinet large enough to accommodate units. Cabinets shall be painted red.

##### 2.1.1 Remote System Audible/Visual Display (LCD)

The remote LCD visual display shall provide a minimum of 168 character identification, consisting of word description and ID number with zone number for each device as displayed on the fire alarm control panel. A rigid plastic, phenolic or metal identification sign which reads "Fire Alarm System Remote LCD" shall be provided at the remote audio/visual display (LCD). The LCD visual display shall be located as shown on the drawings.

### 2.1.2 Circuit Connections

Circuit conductors entering or leaving the panel shall be connected to screw-type terminals with each conductor and terminal marked for identification.

### 2.1.3 System Expansion and Modification Capabilities

Any equipment and software needed by qualified technicians to implement future changes to the fire alarm system shall be provided as part of this contract.

### 2.1.4 Addressable Control Module

The control module shall be capable of operating as a relay (dry contact form C) for interfacing the control panel with other systems, and to control overhead door holders. The module shall be UL listed as compatible with the control panel. The indicating device or the external load being controlled shall be configured as a Style Y notification appliance circuits. The system shall be capable of supervising, audible, visual and dry contact circuits. The control module shall have both an input and output address. The supervision shall detect a short on the supervised circuit and shall prevent power from being applied to the circuit. The control module shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. The control module shall contain an integral LED that flashes each time the control module is polled.

### 2.1.5 Addressable Initiating Device Circuits Module

The initiating device being monitored shall be configured as a Style D initiating device circuits. The system shall be capable of defining any module as an alarm module and report alarm trouble, loss of polling, or as a supervisory module, and reporting supervisory short, supervisory open or loss of polling. The module shall be UL listed as compatible with the control panel. The monitor module shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. Monitor module shall contain an integral LED that flashes each time the monitor module is polled. Pull stations with a monitor module in a common backbox are not required to have an LED.

## 2.2 STORAGE BATTERIES

Storage batteries shall be provided and shall be 24 Vdc sealed, lead-calcium type requiring no additional water. The batteries shall have ample capacity, with primary power disconnected, to operate the fire alarm system for a period of 72 hours. Following this period of battery operation, the batteries shall have ample capacity to operate all components of the system, including all alarm signaling devices in the total alarm mode for a minimum period of 15 minutes. Batteries shall be located at the bottom of the panel. Batteries shall be provided with overcurrent protection in accordance with NFPA 72. Separate battery cabinets shall have a lockable, hinged cover similar to the fire alarm panel. The lock shall be keyed the same as the fire alarm control panel. Cabinets shall be painted to match the fire alarm control panel.

## 2.3 BATTERY CHARGER

Battery charger shall be completely automatic, 24 Vdc with high/low charging rate, capable of restoring the batteries from full discharge (18 Volts dc) to full charge within 48 hours. A pilot light indicating when batteries are manually placed on a high rate of charge shall be provided as part of the unit assembly, if a high rate switch is provided. Charger shall be located in control panel cabinet or in a separate battery cabinet.

#### 2.4 ADDRESSABLE MANUAL FIRE ALARM STATIONS

Addressable manual fire alarm stations shall conform to the applicable requirements of UL 38. Manual stations shall be connected into signal line circuits. Stations shall be installed on flush mounted outlet boxes. Manual stations shall be mounted at 48 inches in areas listed ADA and 54 inches elsewhere. Stations shall be double action type. Stations shall be finished in red, with raised letter operating instructions of contrasting color. Stations requiring the breaking of glass or plastic panels for operation are not acceptable. Stations employing glass rods are not acceptable. The use of a key or wrench shall be required to reset the station. Gravity or mercury switches are not acceptable. Switches and contacts shall be rated for the voltage and current upon which they operate. Addressable pull stations shall be capable of being field programmed, shall latch upon operation and remain latched until manually reset. Stations shall have a separate screw terminal for each conductor. Surface mounted boxes shall be matched and painted the same color as the fire alarm manual stations.

#### 2.5 FIRE DETECTING DEVICES

Fire detecting devices shall comply with the applicable requirements of NFPA 72, NFPA 90A, UL 268, UL 268A, and UL 521. The detectors shall be provided as indicated. Detector base shall have screw terminals for making connections. No solder connections will be allowed. Detectors located in concealed locations (above ceiling, raised floors, etc.) shall have a remote visible indicator LED/LCD. Addressable fire detecting devices shall be dynamically supervised and uniquely identified in the control panel. All fire alarm initiating devices shall be individually addressable, except where indicated.

##### 2.5.1 Heat Detectors

Heat detectors shall be designed for detection of fire by fixed temperature. Heat detector spacing shall be rated in accordance with UL 521. Detectors located in areas subject to moisture or exterior atmospheric conditions shall be types approved for such locations. Heat detectors located in attic spaces or similar concealed spaces below the roof shall be intermediate temperature rated.

##### 2.5.1.1 Fixed Temperature Detectors

Detectors shall be designed for surface outlet box mounting and supported independently of wiring connections. Detectors shall be designed to detect high heat. The detectors shall have a specific temperature setting of 135 degrees F. The UL 521 test rating for the fixed temperature detectors shall be rated for 15 by 15 ft.

##### 2.5.2 Smoke Detectors

Smoke detectors shall be designed for detection of abnormal smoke densities. Smoke detectors shall be photoelectric type. Detectors shall

contain a visible indicator LED/LCD that shows when the unit is in alarm condition. Detectors shall not be adversely affected by vibration or pressure. Detectors shall be the plug-in type in which the detector base contains terminals for making wiring connections. Detectors that are to be installed in concealed (above false ceilings, etc.) locations shall be provided with a remote indicator LED/LCD suitable for mounting in a finished, visible location.

Smoke detectors located in sleeping rooms shall be of the residential type that includes an alarm and strobe. Smoke detector shall be 120 volt and be hardwired to the local receptacle circuit. Detectors shall have battery backup. Upon activation only the alarmed detector notification appliances sound/flash.

#### 2.5.2.1 Photoelectric Detectors

Detectors shall operate on a light scattering concept using an LED light source. Failure of the LED shall not cause an alarm condition. Detectors shall be factory set for sensitivity and shall require no field adjustments of any kind. Detectors shall have an obscuration rating in accordance with UL 268. Addressable smoke detectors shall be capable of having the sensitivity being remotely adjusted by the control panel.

#### 2.5.2.2 Duct Detectors

Duct-mounted photoelectric smoke detectors shall be furnished and installed where indicated and in accordance with NFPA 90A. Units shall consist of a smoke detector as specified in paragraph Photoelectric Detectors, mounted in a special housing fitted with duct sampling tubes. Detector circuitry shall be mounted in a metallic enclosure exterior to the duct. Detectors shall have a manual reset. Detectors shall be rated for air velocities that include air flows between 500 and 4000 fpm. Detectors shall be powered from the fire alarm panel. Sampling tubes shall run the full width of the duct. The duct detector package shall conform to the requirements of NFPA 90A, UL 268A, and shall be UL listed for use in air-handling systems. The control functions, operation, reset, and bypass shall be controlled from the fire alarm control panel. Lights to indicate the operation and alarm condition; and the test and reset buttons shall be visible and accessible with the unit installed and the cover in place. Detectors mounted above 6 feet and those mounted below 6 feet that cannot be easily accessed while standing on the floor, shall be provided with a remote detector indicator panel containing test and reset switches. Remote lamps and switches as well as the affected fan units shall be properly identified in etched plastic placards. Detectors shall have auxiliary contacts to provide control, interlock, and shutdown functions specified in Section 15950A HEATING, VENTILATING AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS. The detectors shall be supplied by the fire alarm system manufacturer to ensure complete system compatibility.

### 2.6 NOTIFICATION APPLIANCES

Audible appliances shall conform to the applicable requirements of UL 464. Devices shall be connected into notification appliance circuits. Devices shall have a separate screw terminal for each conductor. Audible appliances shall generate a unique audible sound from other devices provided in the building and surrounding area. Surface mounted audible appliances shall be painted red.

#### 2.6.1 Alarm Horn/Visual (Water Gong)

Horn shall be surface mounted with the matching mounting back box recessed.

Bells shall be suitable for use in an electrically supervised circuit. Bells shall be the underdome type producing a minimum output rating of 85 dBA at 10 feet. Bells used in exterior locations shall be specifically listed or approved for outdoor use and be provided with metal housing and protective grilles. Single stroke, electrically operated, supervised, solenoid bells shall be used for coded applications.

#### 2.6.2 Alarm Horns

Horns shall be surface mounted, with the matching mounting back box recessed single projector, grille and vibrating type suitable for use in an electrically supervised circuit. Horns shall produce a sound rating of at least 85 dBA at 10 feet. Horns used in exterior locations shall be specifically listed or approved for outdoor use and be provided with metal housing and protective grilles.

#### 2.6.3 Visual Notification Appliances

Visual notification appliances shall conform to the applicable requirements of UL 1971 and the contract drawings. Appliances shall have clear high intensity optic lens, xenon flash tubes, and output white light. Strobe flash rate shall be between 1 to 3 flashes per second and a minimum of 75 candela. Strobe shall be surface mounted.

#### 2.6.4 Combination Audible/Visual Notification Appliances

Combination audible/visual notification appliances shall provide the same requirements as individual units except they shall mount as a unit in standard backboxes. Units shall be factory assembled. Any other audible notification appliance employed in the fire alarm systems shall be approved by the Contracting Officer.

### 2.7 FIRE DETECTION AND ALARM SYSTEM PERIPHERAL EQUIPMENT

#### 2.7.1 Electromagnetic Metal Rolling Counter Door Hold-Open Devices

Devices shall be attached to the walls unless otherwise indicated. Devices shall comply with the appropriate requirements of UL 228. Devices shall operate on 24 Volt dc power. Compatible magnetic component shall be attached to the door. Under normal conditions, the magnets shall attract and hold the doors open. When magnets are de-energized, they shall release the doors. Magnets shall have a holding force of 25 pounds. Devices shall be UL or FM approved. Housing for devices shall be brushed aluminum or stainless steel. Operation shall be fail safe with no moving parts. Electromagnetic door hold-open devices shall not be required to be held open during building power failure.

#### 2.7.2 Conduit

Conduit and fittings shall comply with NFPA 70, UL 6, UL 1242, and UL 797.

#### 2.7.3 Wiring

Wiring shall conform to NFPA 70. Wiring for 120 Vac power shall be No. 12 AWG minimum. The SLC wiring shall be copper cable in accordance with the manufacturers requirements. Wiring for fire alarm dc circuits shall be No. 16 AWG minimum. Voltages shall not be mixed in any junction box, housing, or device, except those containing power supplies and control relays.

Wiring shall conform to NFPA 70. System field wiring shall be solid copper and installed in metallic conduit or electrical metallic tubing, except that rigid plastic conduit may be used under slab-on-grade. Conductors shall be color coded. Conductors used for the same functions shall be similarly color coded. Wiring code color shall remain uniform throughout the circuit. Pigtail or T-tap connections to initiating device circuits, supervisory alarm circuits, and notification appliance circuits are prohibited. T-tapping using screw terminal blocks is allowed for style 5 addressable systems.

#### 2.7.4 Special Tools and Spare Parts

Software, connecting cables and proprietary equipment, necessary for the maintenance, testing, and reprogramming of the equipment shall be furnished to the Contracting Officer. Two spare fuses of each type and size required shall be furnished. Two percent of the total number of each different type of detector, but no less than two each, shall be furnished. Spare fuses shall be mounted in the fire alarm panel.

### 2.8 TRANSMITTERS

#### 2.8.1 Telephonic Reporting System (Automatic Dialer)

Automatic dialer shall comply with applicable requirements of UL 632. Automatic dialer shall respond to the actuation of the fire alarm control panel and process control panels and shall continue to dial until signal is acknowledged at the receiving station. Wiring shall be extended to the indicated telephone terminating location and connected to specific twisted pair cable identified by the Contracting Officer in the field. Automatic dialer shall be programmed with the telephone number furnished by the Contracting Officer in the field.

## PART 3 EXECUTION

### 3.1 INSTALLATION

All work shall be installed as shown, and in accordance with NFPA 70 and NFPA 72, and in accordance with the manufacturer's diagrams and recommendations, unless otherwise specified. Smoke detectors shall not be installed until construction is essentially complete and the building has been thoroughly cleaned.

#### 3.1.1 Power Supply for the System

A single dedicated circuit connection for supplying power from a branch circuit to each building fire alarm system shall be provided. The power shall be supplied as shown on the drawings. The power supply shall be equipped with a locking mechanism and marked in red with the words "FIRE ALARM CIRCUIT CONTROL".

#### 3.1.2 Wiring

Conduit size for wiring shall be in accordance with NFPA 70. Wiring for the fire alarm system shall not be installed in conduits, junction boxes, or outlet boxes with conductors of lighting and power systems. Not more than two conductors shall be installed under any device screw terminal. The wires under the screw terminal shall be straight when placed under the terminal then clamped in place under the screw terminal. The wires shall not be broken and not twisted around the terminal. Circuit conductors

entering or leaving any mounting box, outlet box enclosure, or cabinet shall be connected to screw terminals with each terminal and conductor marked in accordance with the wiring diagram. Connections and splices shall be made using screw terminal blocks. The use of wire nut type connectors in the system is prohibited. Wiring within any control equipment shall be readily accessible without removing any component parts. The fire alarm equipment manufacturer's representative shall be present for the connection of wiring to the control panel.

### 3.1.3 Control Panel

The control panel and its assorted components shall be mounted so that no part of the enclosing cabinet is less than 12 inches nor more than 78 inches above the finished floor. Manually operable controls shall be between 36 and 42 inches above the finished floor. Panel shall be installed to comply with the requirements of UL 864.

### 3.1.4 Detectors

Detectors shall be located and installed in accordance with NFPA 72. Detectors shall be connected into signal line circuits or initiating device circuits as indicated on the drawings. Detectors shall be at least 12 inches from any part of any lighting fixture. Detectors shall be located at least 3 feet from diffusers of air handling systems. Each detector shall be provided with appropriate mounting hardware as required by its mounting location. Detectors which mount in open space shall be mounted directly to the end of the stubbed down rigid conduit drop. Conduit drops shall be firmly secured to minimize detector sway. Where length of conduit drop from ceiling or wall surface exceeds 3 feet, sway bracing shall be provided.

### 3.1.5 Notification Appliances

Notification appliances shall be mounted 80 inches above the finished floor or 6 inches below the ceiling, whichever is lower.

### 3.1.6 Annunciator Equipment

Annunciator equipment shall be mounted where indicated on the drawings.

### 3.1.7 Addressable Initiating Device Circuits Module

The initiating device circuits module shall be used to connect supervised conventional initiating devices (water flow switches, water pressure switches, manual fire alarm stations, high/low air pressure switches, and tamper switches). The module shall mount in an electrical box adjacent to or connected to the device it is monitoring and shall be capable of Style B supervised wiring to the initiating device. In order to maintain proper supervision, there shall be no T-taps allowed on style B lines. Addressable initiating device circuits modules shall monitor only one initiating device each. Contacts in suppression systems and other fire protection subsystems shall be connected to the fire alarm system to perform supervisory and alarm functions as specified in Section 13930A WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION.

### 3.1.8 Addressable Control Module

Addressable and control modules shall be installed in the outlet box or adjacent to the device they are controlling. If a supplementary

suppression releasing panel is provided, then the monitor modules shall be mounted in a common enclosure adjacent to the suppression releasing panel and both this enclosure and the suppression releasing panel shall be in the same room as the releasing devices. All interconnecting wires shall be supervised unless an open circuit or short circuit abnormal condition does not affect the required operation of the fire alarm system. If control modules are used as interfaces to other systems, such as HVAC or elevator control, they shall be within the control panel or immediately adjacent to it. Control modules that control a group of notification appliances shall be adjacent to the first notification appliance in the notification appliance circuits. Control modules that connect to devices shall supervise the notification appliance circuits. Control modules that connect to auxiliary systems or interface with other systems (non-life safety systems) and where not required by NFPA 72, shall not require the secondary circuits to be supervised. Contacts in suppression systems and other fire protection subsystems shall be connected to the fire alarm system to perform required alarm functions as specified in Section 13930A WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION.

### 3.2 OVERVOLTAGE AND SURGE PROTECTION

#### 3.2.1 Power Line Surge Protection

All equipment connected to alternating current circuits shall be protected from surges per IEEE C62.41 B3 combination waveform and NFPA 70. Fuses shall not be used for surge protection. The surge protector shall be rated for a maximum let thru voltage of 350 Volts ac (line-to-neutral) and 350 Volt ac (neutral-to-ground).

#### 3.2.2 Low Voltage DC Circuits Surge Protection

All IDC, NAC, and communication cables/conductors, except fiber optics, shall have surge protection installed at each point where it exits or enters a building. Equipment shall be protected from surges per IEEE C62.41 B3 combination waveform and NFPA 70. The surge protector shall be rated to protect the 24 Volt dc equipment. The maximum dc clamping voltages shall be 36 V (line-to-ground) and 72 Volt dc (line-to-line).

#### 3.2.3 Signal Line Circuit Surge Protection

All SLC cables/conductors, except fiber optics, shall have surge protection/isolation circuits installed at each point where it exits or enters a building. The circuit shall be protected from surges per IEEE C62.41 B3 combination waveform and NFPA 70. The surge protector/isolator shall be rated to protect the equipment.

### 3.3 GROUNDING

Grounding shall be provided by connecting to building ground system.3.4 TESTING

The Contractor shall notify the Contracting Officer at least 10 days before the preliminary and acceptance tests are to be conducted. The tests shall be performed in accordance with the approved test procedures in the presence of the Contracting Officer. The control panel manufacturer's representative shall be present to supervise tests. The Contractor shall furnish instruments and personnel required for the tests.

#### 3.4.1 Preliminary Tests

Upon completion of the installation, the system shall be subjected to functional and operational performance tests including tests of each installed initiating and notification appliance, when required. Tests shall include the meggering of system conductors to determine that the system is free from grounded, shorted, or open circuits. The megger test shall be conducted prior to the installation of fire alarm equipment. If deficiencies are found, corrections shall be made and the system shall be retested to assure that it is functional. After completing the preliminary testing the Contractor shall complete and submit the NFPA 72, Certificate of Completion.

#### 3.4.2 Acceptance Test

Acceptance testing shall not be performed until the Contractor has completed and submitted the Certificate of Completion. Testing shall be in accordance with NFPA 72. The recommended tests in NFPA 72 shall be considered mandatory and shall verify that previous deficiencies have been corrected. The Contractor shall complete and submit the NFPA 72, Inspection and Testing Form. The test shall include all requirements of NFPA 72 and the following:

- a. Test of each function of the control panel.
- b. Test of each circuit in both trouble and normal modes.
- c. Tests of each alarm initiating devices in both normal and trouble conditions.
- d. Tests of each control circuit and device.
- e. Tests of each alarm notification appliance.
- f. Tests of the battery charger and batteries.
- g. Complete operational tests under emergency power supply.
- h. Visual inspection of wiring connections.
- i. Opening the circuit at each alarm initiating device and notification appliance to test the wiring supervisory feature.
- j. Ground fault
- k. Short circuit faults
- l. Stray voltage
- m. Loop resistance

#### 3.5 TRAINING

Training course shall be provided for the operations and maintenance staff. The course shall be conducted in the building where the system is installed or as designated by the Contracting Officer. The training period for systems operation shall consist of 1 training days (8 hours per day) and shall start after the system is functionally completed but prior to final acceptance tests.

-- End of Section --

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## SECTION 13930A

WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION  
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## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM A 135	(2001) Electric-Resistance-Welded Steel Pipe
ASTM A 183	(1998) Carbon Steel Track Bolts and Nuts
ASTM A 47/A 47M	(1999) Ferritic Malleable Iron Castings
ASTM A 53/A 53M	(2001) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 536	(1984; R 1999e1) Ductile Iron Castings
ASTM A 795	(2000) Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM F 436	(1993; R 2000) Hardened Steel Washers

## AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1015	(1999) Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Prevention Assemblies
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## AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA B300	(1999) Hypochlorites
AWWA B301	(1999) Liquid Chlorine
AWWA C104	(1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110	(1998) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1219 mm), for Water

AWWA C111	(2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C151	(1996) Ductile-Iron Pipe, Centrifugally Cast, for Water
AWWA C203	(1997; C203a99) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA EWW	(1998) Standard Methods for the Examination of Water and Wastewater
AWWA M20	(1973) Manual: Water Chlorination Principles and Practices

## ASME INTERNATIONAL (ASME)

ASME B16.1	(1998) Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.11	(2001) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.3	(1998) Malleable Iron Threaded Fittings
ASME B16.4	(1998) Gray Iron Threaded Fittings
ASME B16.9	(2001) Factory-Made Wrought Steel Buttwelding Fittings
ASME B18.2.1	(1996) Square and Hex Bolts and Screws, Inch Series
ASME B18.2.2	(1987; R 1999) Square and Hex Nuts (Inch Series)

## FM GLOBAL (FM)

FM P7825a	(2002) Approval Guide Fire Protection
FM P7825b	(2002) Approval Guide Electrical Equipment

## MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-71	(1997) Gray Iron Swing Check Valves, Flanged and Threaded Ends
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## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13	(1999) Installation of Sprinkler Systems
NFPA 1963	(1998) Fire Hose Connections
NFPA 230	(1999) Fire Protection of Storage

NFPA 24 (1995) Installation of Private Fire Service Mains and Their Appurtenances

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET)

NICET 1014-7 (1995) Program Detail Manual for Certification in the Field of Fire Protection Engineering Technology (Field Code 003) Subfield of Automatic Sprinkler System Layout

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir (1999) Building Materials Directory

UL Fire Prot Dir (2001) Fire Protection Equipment Directory

## 1.2 GENERAL REQUIREMENTS

Wet pipe sprinkler system shall be provided in all areas of the building. The sprinkler system shall provide fire sprinkler protection for the entire area. Except as modified herein, the system shall be designed and installed in accordance with NFPA 13. Pipe sizes which are not indicated on drawings shall be determined by hydraulic calculation. The Contractor shall design any portions of the sprinkler system that are not indicated on the drawings including locating sprinklers, piping and equipment, and size piping and equipment when this information is not indicated on the drawings or is not specified herein. The design of the sprinkler system shall be based on hydraulic calculations, and the other provisions specified herein.

### 1.2.1 Hydraulic Design

The system shall be hydraulically designed to discharge a minimum density o as shown on the drawings over the hydraulically most demanding 3,000 square feet of floor area. The minimum pipe size for branch lines in gridded systems shall be 1-1/4 inch. Hydraulic calculations shall be in accordance with the Area/Density Method of NFPA 13. Water velocity in the piping shall not exceed 20 ft/s.

#### 1.2.1.1 Hose Demand

An allowance for exterior hose streams shall be added to the sprinkler system demand at the fire hydrant shown on the drawings closest to the point where the water service enters the building.

#### 1.2.1.2 Basis for Calculations

The design of the system shall be based upon a water supply with a static pressure of 119 psi, and a flow of 540 gpm at a residual pressure of 99 psi. Water supply shall be presumed available at the point of connection to existing. Hydraulic calculations shall be based upon the Hazen-Williams formula with a "C" value of 120 for steel piping, 150 for copper tubing, 140 for new cement-lined ductile-iron piping, and 100 for existing underground piping.

### 1.2.2 Sprinkler Coverage

Sprinklers shall be uniformly spaced on branch lines. In buildings protected by automatic sprinklers, sprinklers shall provide coverage throughout 100 percent of the building. This includes, but is not limited to, telephone rooms, electrical equipment rooms, boiler rooms, switchgear rooms, transformer rooms, and other electrical and mechanical spaces. Coverage per sprinkler shall be in accordance with NFPA 13; as specified in NFPA 13 for extra hazard occupancy but not to exceed 225 square feet for light hazard or 130 square feet for ordinary hazard occupancies.

### 1.3 COORDINATION OF TRADES

Piping offsets, fittings, and any other accessories required shall be furnished as required to provide a complete installation and to eliminate interference with other construction. Sprinkler shall be installed over and under ducts, piping and platforms when such equipment can negatively effect or disrupt the sprinkler discharge pattern and coverage.

### 1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be housed in a manner to preclude any damage from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, all pipes shall either be capped or plugged until installed.

### 1.5 FIELD MEASUREMENTS

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

### 1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

Shop Drawings; G-DO.

Three copies of the Sprinkler System Shop Drawings, no later than 21 days prior to the start of sprinkler system installation.

As-Built Drawings;

As-built shop drawings, at least 14 days after completion of the Final Tests. The Sprinkler System Drawings shall be updated to reflect as-built conditions after all related work is completed and shall be on reproducible full-size mylar film.

#### SD-03 Product Data

Fire Protection Related Submittals; G-AO.

A list of the Fire Protection Related Submittals, no later than 7 days after the approval of the Fire Protection Specialist.

Sway Bracing; G-DO.

For systems that are required to be protected against damage from earthquakes, load calculations shall be provided for sizing of sway bracing.

Materials and Equipment; G-DO.

Manufacturer's catalog data included with the Sprinkler System Drawings for all items specified herein. The data shall be highlighted to show model, size, options, etc., that are intended for consideration. Data shall be adequate to demonstrate compliance with all contract requirements. In addition, a complete equipment list that includes equipment description, model number and quantity shall be provided.

Hydraulic Calculations; G-DO.

Hydraulic calculations, including a drawing showing hydraulic reference points and pipe segments.

Spare Parts;

Spare parts data shall be included for each different item of material and equipment specified.

Preliminary Tests; G-AO.

Proposed procedures for Preliminary Tests, no later than 14 days prior to the proposed start of the tests. Proposed date and time to begin the preliminary tests.

Final Acceptance Test; G-AO.

Proposed procedures for Final Acceptance Test, no later than 14 days prior to the proposed start of the tests. Proposed date and time to begin Final Acceptance Test, submitted with the Final Acceptance Test Procedures. Notification shall be provided at least 14 days prior to the proposed start of the test. Notification shall include a copy of the Contractor's Material & Test Certificates.

On-site Training; G-AO.

Proposed On-site Training schedule, at least 14 days prior to the start of related training.

Fire Protection Specialist; G-DO.

The name and documentation of certification of the proposed Fire Protection Specialists, no later than 14 days after the Notice to Proceed and prior to the submittal of the sprinkler system drawings and hydraulic calculations.

Sprinkler System Installer; G-DO.

The name and documentation of certification of the proposed Sprinkler System Installer, concurrent with submittal of the Fire Protection Specialist Qualifications.

## SD-06 Test Reports

Preliminary Test Report; G-AO.

Three copies of the completed Preliminary Test Report, no later than 7 days after the completion of the Preliminary Tests. The Preliminary Tests Report shall include both the Contractor's Material and Test Certificate for Underground Piping and the Contractor's Material and Test Certificate for Aboveground Piping. All items in the Preliminary Tests Report shall be signed by the Fire Protection Specialist.

Final Acceptance Test Report; G-AO.

Three copies of the completed Final Acceptance Tests Reports, no later than 7 days after the completion of the Final Acceptance Tests. All items in the Final Acceptance Report shall be signed by the Fire Protection Specialist.

## SD-07 Certificates

Inspection by Fire Protection Specialist; G-AO.

Concurrent with the Final Acceptance Test Report, certification by the Fire Protection Specialist that the sprinkler system is installed in accordance with the contract requirements, including signed approval of the Preliminary and Final Acceptance Test Reports.

## SD-10 Operation and Maintenance Data

Operation and Maintenance Instructions; G-AO.

Six manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 14 days prior to field training. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization submitted shall be capable of providing 24 hour on-site response to a service call on an emergency basis.

## 1.7 HYDRAULIC CALCULATIONS

Hydraulic calculations shall be as outlined in NFPA 13 except that calculations shall be performed by computer using software intended specifically for fire protection system design using the design data shown on the drawings. Software that uses k-factors for typical branch lines is not acceptable. Calculations shall be based on the water supply data shown on the drawings. Calculations shall substantiate that the design area used in the calculations is the most demanding hydraulically. Water supply curves and system requirements shall be plotted on semi-logarithmic graph paper so as to present a summary of the complete hydraulic calculation. A summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, actual discharge pressures and

actual flows shall be provided. Elevations of hydraulic reference points (nodes) shall be indicated. Documentation shall identify each pipe individually and the nodes connected thereto. The diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient shall be indicated for each pipe. For gridded systems, calculations shall show peaking of demand area friction loss to verify that the hydraulically most demanding area is being used. Also for gridded systems, a flow diagram indicating the quantity and direction of flows shall be included. A drawing showing hydraulic reference points (nodes) and pipe designations used in the calculations shall be included and shall be independent of shop drawings.

#### 1.8 FIRE PROTECTION SPECIALIST

Work specified in this section shall be performed under the supervision of and certified by the Fire Protection Specialist. The Fire Protection Specialist shall be an individual who is a registered professional engineer and a Full Member of the Society of Fire Protection Engineers or who is certified as a Level III Technician by National Institute for Certification in Engineering Technologies (NICET) in the Automatic Sprinkler System Layout subfield of Fire Protection Engineering Technology in accordance with NICET 1014-7. The Fire Protection Specialist shall be regularly engaged in the design and installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

#### 1.9 SPRINKLER SYSTEM INSTALLER

Work specified in this section shall be performed by the Sprinkler System Installer. The Sprinkler System Installer shall be regularly engaged in the installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

#### 1.10 REGULATORY REQUIREMENTS

Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall govern. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

#### 1.11 SPARE PARTS

The Contractor shall submit spare parts data for each different item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. A list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor shall be included.

#### 1.12 SHOP DRAWINGS

The Sprinkler System Shop Drawings shall conform to the requirements established for working plans as prescribed in NFPA 13. Drawings shall include plan and elevation views demonstrating that the equipment will fit the allotted spaces with clearance for installation and maintenance. Each set of drawings shall include the following:

a. Descriptive index of drawings in the submittal with drawings listed in sequence by drawing number. A legend identifying device symbols, nomenclature, and conventions used.

b. Floor plans drawn to a scale not less than 1/8" = 1'-0" which clearly show locations of sprinklers, risers, pipe hangers, seismic separation assemblies, sway bracing, inspector's test connections, drains, and other applicable details necessary to clearly describe the proposed arrangement. Each type of fitting used and the locations of bushings, reducing couplings, and welded joints shall be indicated.

c. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinklers to adjacent walls; from walls to branch lines; from sprinkler feed mains, cross-mains and branch lines to finished floor and roof or ceiling. A detail shall show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.

d. Longitudinal and transverse building sections showing typical branch line and cross-main pipe routing as well as elevation of each typical sprinkler above finished floor.

e. Details of each type of riser assembly; pipe hanger; sway bracing for earthquake protection, and restraint of underground water main at point-of-entry into the building, and electrical devices and interconnecting wiring.

## PART 2 PRODUCTS

### 2.1 STANDARD PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

### 2.2 NAMEPLATES

All equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

### 2.3 REQUIREMENTS FOR FIRE PROTECTION SERVICE

Materials and Equipment shall have been tested by Underwriters Laboratories, Inc. and listed in UL Fire Prot Dir or approved by Factory Mutual and listed in FM P7825a and FM P7825b. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in UL Fire Prot Dir or FM P7825a and FM P7825b.

### 2.4 UNDERGROUND PIPING COMPONENTS

#### 2.4.1 Pipe

Piping from a point 6 inches above the floor to a point 5 feet outside the building wall shall be ductile iron with a rated working pressure of 175 psi conforming to AWWA C151, with cement mortar lining conforming to AWWA C104. Piping more than 5 feet outside the building walls shall comply with Section 02510A WATER DISTRIBUTION SYSTEM.

#### 2.4.2 Fittings and Gaskets

Fittings shall be ductile iron conforming to AWWA C110. Gaskets shall be suitable in design and size for the pipe with which such gaskets are to be used. Gaskets for ductile iron pipe joints shall conform to AWWA C111.

#### 2.4.3 Gate Valve and Indicator Posts

Gate valves for underground installation shall be of the inside screw type with counter-clockwise rotation to open. Where indicating type valves are shown or required, indicating valves shall be gate valves with an approved indicator post of a length to permit the top of the post to be located 3 feet above finished grade. Gate valves and indicator posts shall be listed in UL Fire Prot Dir or FM P7825a and FM P7825b.

### 2.5 ABOVEGROUND PIPING COMPONENTS

Aboveground piping shall be steel.

#### 2.5.1 Steel Piping Components

##### 2.5.1.1 Steel Pipe

Except as modified herein, steel pipe shall be black as permitted by NFPA 13 and shall conform to applicable provisions of ASTM A 795, ASTM A 53/A 53M, or ASTM A 135. Pipe in which threads or grooves are cut shall be Schedule 40 or shall be listed by Underwriters' Laboratories to have a corrosion resistance ratio (CRR) of 1.0 or greater after threads or grooves are cut. Pipe shall be marked with the name of the manufacturer, kind of pipe, and ASTM designation.

##### 2.5.1.2 Fittings for Non-Grooved Steel Pipe

Fittings shall be cast iron conforming to ASME B16.4, steel conforming to ASME B16.9 or ASME B16.11, or malleable iron conforming to ASME B16.3. Steel press fittings shall not be permitted. Fittings into which sprinklers, drop nipples or riser nipples (sprigs) are screwed shall be threaded type. Plain-end fittings with mechanical couplings, fittings that use steel gripping devices to bite into the pipe and segmented welded fittings shall not be used.

##### 2.5.1.3 Grooved Mechanical Joints and Fittings

Joints and fittings shall be designed for not less than 175 psi service and shall be the product of the same manufacturer; segmented welded fittings shall not be used. Fitting and coupling houses shall be malleable iron conforming to ASTM A 47/A 47M, Grade 32510; ductile iron conforming to ASTM A 536, Grade 65-45-12. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A 183 and shall be cadmium plated or zinc electroplated.

#### 2.5.1.4 Flanges

Flanges shall conform to NFPA 13 and ASME B16.1. Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 1/16 inch thick, and full face or self-centering flat ring type.

#### 2.5.1.5 Bolts, Nut, and Washers

Bolts shall be squarehead conforming to ASME B18.2.1 and shall extend no less than three full threads beyond the nut with bolts tightened to the required torque. Nuts shall be hexagon type conforming to ASME B18.2.2 . Washers shall meet the requirements of ASTM F 436. Flat circular washers shall be provided under all bolt heads and nuts.

#### 2.5.2 Pipe Hangers

Hangers shall be listed in UL Fire Prot Dir or FM P7825a and FM P7825b and of the type suitable for the application, construction, and pipe type and sized to be supported.

#### 2.5.3 Valves

##### 2.5.3.1 Control Valve and Gate Valve

Manually operated sprinkler control valve and gate valve shall be outside stem and yoke (OS&Y) type and shall be listed in UL Bld Mat Dir or FM P7825a and FM P7825b.

##### 2.5.3.2 Check Valve

Check valve 2 inches and larger shall be listed in UL Bld Mat Dir or FM P7825a and FM P7825b. Check valves 4 inches and larger shall be of the swing type with flanged cast iron body and flanged inspection plate, shall have a clear waterway and shall meet the requirements of MSS SP-71, for Type 3 or 4.

#### 2.6 WATERFLOW ALARM

Electrically operated, exterior-mounted, waterflow alarm bell shall be provided and installed in accordance with NFPA 13. Waterflow alarm bell shall be rated 24 VDC and shall be connected to the Fire Alarm Control Panel(FACP) in accordance with Section 13851A FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE

#### 2.7 ALARM INITIATING AND SUPERVISORY DEVICES

##### 2.7.1 Sprinkler Waterflow Indicator Switch, Vane Type

Switch shall be vane type with a pipe saddle and cast aluminum housing. The electro-mechanical device shall include a flexible, low-density polyethylene paddle conforming to the inside diameter of the fire protection pipe. The device shall sense water movements and be capable of detecting a sustained flow of 10 gpm or greater. The device shall contain a retard device adjustable from 0 to 90 seconds to reduce the possibility of false alarms caused by transient flow surges. The switch shall be tamper resistant and contain two SPDT (Form C) contacts arranged to

transfer upon removal of the housing cover, and shall be equipped with a silicone rubber gasket to assure positive water seal and a dustproof cover and gasket to seal the mechanism from dirt and moisture.

#### 2.7.2 Valve Supervisory (Tamper) Switch

Switch shall be suitable for mounting to the type of control valve to be supervised open. The switch shall be tamper resistant and contain one set of SPDT (Form C) contacts arranged to transfer upon removal of the housing cover or closure of the valve of more than two rotations of the valve stem.

#### 2.8 FIRE DEPARTMENT CONNECTION

Fire department connection shall be projecting type with cast brass body, matching wall escutcheon lettered "Auto Spkr" with a polished brass finish. The connection shall have two inlets with individual self-closing clappers, caps with drip drains and chains. Female inlets shall have 2-1/2 inch diameter American National Fire Hose Connection Screw Threads (NH) per NFPA 1963 .

#### 2.9 SPRINKLERS

Sprinklers with internal O-rings shall not be used. Sprinklers shall be used in accordance with their listed coverage limitations. Temperature classification shall be ordinary. Sprinklers in high heat areas including attic spaces or in close proximity to unit heaters shall have temperature classification in accordance with NFPA 13. Extended coverage sprinklers shall not be used.

##### 2.9.1 Pendent Sprinkler

Pendent sprinkler shall be of the fusible strut or glass bulb type, recessed, quick-response type with nominal 1/2 inch or 17/32 inch orifice. Pendent sprinklers shall have a white polyester finish.

##### 2.9.2 Upright Sprinkler

Upright sprinkler shall be brass and shall have a nominal 1/2 inch or 17/32 inch orifice.

##### 2.9.3 Sidewall Sprinkler

Sidewall sprinkler shall have a nominal 1/2 inch orifice. Sidewall sprinkler shall have a white polyester finish. Sidewall sprinkler shall be the quick-response type.

##### 2.9.4 Corrosion Resistant Sprinkler

Corrosion resistant sprinkler shall be the upright type installed in locations as indicated. Corrosion resistant coatings shall be factory-applied by the sprinkler manufacturer.

##### 2.9.5 Dry Sprinkler Assembly

Assembly shall include an integral escutcheon. Maximum length shall not exceed maximum indicated in UL Fire Prot Dir. Sprinklers shall have a

white enamel finish.

## 2.10 DISINFECTING MATERIALS

### 2.10.1 Liquid Chlorine

Liquid chlorine shall conform to AWWA B301.

### 2.10.2 Hypochlorites

Calcium hypochlorite and sodium hypochlorite shall conform to AWWA B300.

## 2.11 ACCESSORIES

### 2.11.1 Sprinkler Cabinet

Spare sprinklers shall be provided in accordance with NFPA 13 and shall be packed in a suitable metal or plastic cabinet. Spare sprinklers shall be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. At least one wrench of each type required shall be provided.

### 2.11.2 Pendent Sprinkler Escutcheon

Escutcheon shall be one-piece metallic type with a depth of less than 3/4 inch and suitable for installation on pendent sprinklers. The escutcheon shall have a factory finish that matches the pendent sprinkler heads.

### 2.11.3 Pipe Escutcheon

Escutcheon shall be polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or set screw.

### 2.11.4 Sprinkler Guard

Guard shall be a steel wire cage designed to encase the sprinkler and protect it from mechanical damage. Guards shall be provided on sprinklers subject to damage.

### 2.11.5 Identification Sign

Valve identification sign shall be minimum 6 inches wide x 2 inches high with enamel baked finish on minimum 18 gauge steel or 0.024 inch aluminum with red letters on a white background or white letters on red background. Wording of sign shall include, but not be limited to "main drain," "auxiliary drain," "inspector's test," "alarm test," "alarm line," and similar wording as required to identify operational components.

## 2.12 DOUBLE-CHECK VALVE BACKFLOW PREVENTION ASSEMBLY

Double-check backflow prevention assembly shall comply with ASSE 1015. The assembly shall have a bronze, cast-iron or stainless steel body with flanged ends. The assembly shall include pressure gauge test ports and OS&Y shutoff valves on the inlet and outlet, 2-positive-seating check valve for continuous pressure application, and four test cocks. Assemblies shall be rated for working pressure of 175 psi. The maximum pressure loss shall be 6 psi at a flow rate equal to the sprinkler water demand, at the

location of the assembly. A test port for a pressure gauge shall be provided both upstream and downstream of the double check backflow prevention assembly valves.

### PART 3 EXECUTION

#### 3.1 FIRE PROTECTION RELATED SUBMITTALS

The Fire Protection Specialist shall prepare a list of the submittals from the Contract Submittal Register that relate to the successful installation of the sprinkler systems(s). The submittals identified on this list shall be accompanied by a letter of approval signed and dated by the Fire Protection Specialist when submitted to the Government.

#### 3.2 INSTALLATION REQUIREMENTS

The installation shall be in accordance with the applicable provisions of NFPA 13, NFPA 24 and publications referenced therein. Installation of in-rack sprinklers shall comply with applicable provisions of NFPA 230.

#### 3.3 INSPECTION BY FIRE PROTECTION SPECIALIST

The Fire Protection Specialist shall inspect the sprinkler system periodically during the installation to assure that the sprinkler system is being provided and installed in accordance with the contract requirements. The Fire Protection Specialist shall witness the preliminary and final tests, and shall sign the test results. The Fire Protection Specialist, after completion of the system inspections and a successful final test, shall certify in writing that the system has been installed in accordance with the contract requirements. Any discrepancy shall be brought to the attention of the Contracting Officer in writing, no later than three working days after the discrepancy is discovered.

#### 3.4 ABOVEGROUND PIPING INSTALLATION

##### 3.4.1 Protection of Piping Against Earthquake Damage

The system piping shall be protected against damage from earthquakes. Seismic protection shall include flexible and rigid couplings, sway bracing, seismic separation assemblies where piping crosses building seismic separation joints, and other features as required by NFPA 13 for protection of piping against damage from earthquakes.

##### 3.4.2 Piping in Exposed Areas

Exposed piping shall be installed so as not to diminish exit access widths, corridors or equipment access. Exposed horizontal piping, including drain piping, shall be installed to provide maximum headroom.

##### 3.4.3 Piping in Finished Areas

In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, piping shall be concealed above ceilings. Piping shall be inspected, tested and approved before being concealed. Risers and similar vertical runs of piping in finished areas shall be concealed.

##### 3.4.4 Pendent Sprinklers

Drop nipples to pendent sprinklers shall consist of minimum 1 inch pipe

with a reducing coupling into which the sprinkler shall be threaded. Hangers shall be provided on arm-overs to drop nipples supplying pendent sprinklers when the arm-over exceeds 12 inches. Where sprinklers are installed below suspended or dropped ceilings, drop nipples shall be cut such that sprinkler ceiling plates or escutcheons are of a uniform depth throughout the finished space. The outlet of the reducing coupling shall not extend more than 1 inch below the underside of the ceiling. On pendent sprinklers installed below suspended or dropped ceilings, the distance from the sprinkler deflector to the underside of the ceiling shall not exceed 4 inches. Recessed pendent sprinklers shall be installed such that the distance from the sprinkler deflector to the underside of the ceiling shall not exceed the manufacturer's listed range and shall be of uniform depth throughout the finished area.

#### 3.4.4.1 Pendent Sprinkler Locations

Pendent sprinklers in suspended ceilings shall be a minimum of 6 inches from ceiling grid.

#### 3.4.5 Upright Sprinklers

Riser nipples or "sprigs" to upright sprinklers shall contain no fittings between the branch line tee and the reducing coupling at the sprinkler. Riser nipples exceeding 30 inches in length shall be individually supported.

#### 3.4.6 Pipe Joints

Pipe joints shall conform to NFPA 13, except as modified herein. Not more than four threads shall show after joint is made up. Welded joints will be permitted, only if welding operations are performed as required by NFPA 13 at the Contractor's fabrication shop, not at the project construction site.

Flanged joints shall be provided where indicated or required by NFPA 13. Grooved pipe and fittings shall be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness and size. Grooved couplings, fittings and grooving tools shall be products of the same manufacturer. For copper tubing, pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

#### 3.4.7 Reducers

Reductions in pipe sizes shall be made with one-piece tapered reducing fittings. The use of grooved-end or rubber-gasketed reducing couplings will not be permitted. When standard fittings of the required size are not manufactured, single bushings of the face type will be permitted. Where used, face bushings shall be installed with the outer face flush with the face of the fitting opening being reduced. Bushings shall not be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 1/2 inch.

#### 3.4.8 Pipe Penetrations

Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors shall be core-drilled and provided with pipe sleeves. Each sleeve shall be Schedule 40 galvanized steel, ductile iron or cast iron pipe and shall extend through its respective wall or floor and be cut flush with each wall surface. Sleeves shall provide required clearance between the pipe and the sleeve per NFPA 13. The space between the sleeve and the pipe shall be firmly packed with mineral wool insulation. Where pipes penetrate fire walls, fire partitions, or floors, pipes shall be fire stopped in accordance with Section 07840A FIRESTOPPING.

In penetrations that are not fire-rated or not a floor penetration, the space between the sleeve and the pipe shall be sealed at both ends with plastic waterproof cement that will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.

#### 3.4.9 Escutcheons

Escutcheons shall be provided for pipe penetration of ceilings and walls. Escutcheons shall be securely fastened to the pipe at surfaces through which piping passes.

#### 3.4.10 Inspector's Test Connection

Unless otherwise indicated, test connection shall consist of 1 inch pipe connected to the remote branch line; a test valve located approximately 7 feet above the floor; a smooth bore brass outlet equivalent to the smallest orifice sprinkler used in the system; and a painted metal identification sign affixed to the valve with the words "Inspector's Test." The discharge orifice shall be located outside the building wall directed so as not to cause damage to adjacent construction or landscaping during full flow discharge.

#### 3.4.11 Drains

Main drain piping shall be provided to discharge at a safe point outside the building. Auxiliary drains shall be provided as required by NFPA 13.

#### 3.4.12 Installation of Fire Department Connection

Connection shall be mounted on the exterior wall approximately 3 feet above finished grade. The piping between the connection and the check valve shall be provided with an automatic drip in accordance with NFPA 13 and arranged to drain to the outside.

#### 3.4.13 Identification Signs

Signs shall be affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate or as required by NFPA 13. Hydraulic design data nameplates shall be permanently affixed to each sprinkler riser as specified in NFPA 13.

### 3.5 UNDERGROUND PIPING INSTALLATION

The fire protection water main shall be laid, and joints anchored, in accordance with NFPA 24. Minimum depth of cover shall be 4 feet. The supply line shall terminate inside the building with a flanged piece, the bottom of which shall be set not less than 6 inches above the finished floor. A blind flange shall be installed temporarily on top of the flanged

piece to prevent the entrance of foreign matter into the supply line. A concrete thrust block shall be provided at the elbow where the pipe turns up toward the floor. In addition, joints shall be anchored in accordance with NFPA 24 using pipe clamps and steel rods from the elbow to the flange above the floor and from the elbow to a pipe clamp in the horizontal run of pipe. Buried steel components shall be provided with a corrosion protective coating in accordance with AWWA C203. Piping more than 5 feet outside the building walls shall meet the requirements of Section 02510A WATER DISTRIBUTION SYSTEM.

### 3.6 EARTHWORK

Earthwork shall be performed in accordance with applicable provisions of Section 02315A EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS.

### 3.7 ELECTRICAL WORK

Except as modified herein, electric equipment and wiring shall be in accordance with Section 16415A ELECTRICAL WORK, INTERIOR. Alarm signal wiring connected to the building fire alarm control system shall be in accordance with Section 13851A FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE. Wiring color code shall remain uniform throughout the system.

### 3.8 DISINFECTION

After all system components are installed and hydrostatic test(s) are successfully completed, each portion of the sprinkler system to be disinfected shall be thoroughly flushed with potable water until all entrained dirt and other foreign materials have been removed before introducing chlorinating material. Flushing shall be conducted by removing the flushing fitting of the cross mains and of the grid branch lines, and then back-flushing through the sprinkler main drains. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA M20. The chlorinating material shall be fed into the sprinkler piping at a constant rate of 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or liquid chlorine injected into the system through a solution-fed chlorinator and booster pump shall be used. Chlorination application shall continue until the entire system is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system shall be opened and closed several times to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. The system shall then be flushed with clean water until the residual chlorine is reduced to less than one part per million. Samples of water in disinfected containers for bacterial examination will be taken from several system locations which are approved by the Contracting Officer. Samples shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA EWW. The testing method shall be either the multiple-tube fermentation technique or the membrane-filter technique. The disinfection shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained. After successful completion, verify installation of all sprinklers and plugs and pressure test the system.

### 3.9 PIPE COLOR CODE MARKING

Color code marking of piping shall be as specified in Section 09900 PAINTS AND COATINGS.

### 3.10 PRELIMINARY TESTS

The system, including the underground water mains, and the aboveground piping and system components, shall be tested to assure that equipment and components function as intended. The underground and aboveground interior piping systems and attached appurtenances subjected to system working pressure shall be tested in accordance with NFPA 13 and NFPA 24. Upon completion of specified tests, the Contractor shall complete certificates as specified in paragraph SUBMITTALS.

#### 3.10.1 Underground Piping

##### 3.10.1.1 Flushing

Underground piping shall be flushed in accordance with NFPA 24. This includes the requirement to flush the lead-in connection to the fire protection system at a flow rate not less than the calculated maximum water demand rate of the system.

##### 3.10.1.2 Hydrostatic Testing

New underground piping shall be hydrostatically tested in accordance with NFPA 24. The allowable leakage shall be measured at the specified test pressure by pumping from a calibrated container. The amount of leakage at the joints shall not exceed 2 quarts per hour per 100 gaskets or joints, regardless of pipe diameter.

#### 3.10.2 Aboveground Piping

##### 3.10.2.1 Hydrostatic Testing

Aboveground piping shall be hydrostatically tested in accordance with NFPA 13 at not less than 200 psi or 50 psi in excess of maximum system operating pressure and shall maintain that pressure without loss for 2 hours. There shall be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested.

##### 3.10.2.2 Backflow Prevention Assembly Forward Flow Test

Each backflow prevention assembly shall be tested at system flow demand, including all applicable hose streams, as specified in NFPA 13. The Contractor shall provide all equipment and instruments necessary to conduct a complete forward flow test, including 2.5 inch diameter hoses, playpipe nozzles, calibrated pressure gauges, and pitot tube gauge. The Contractor shall provide all necessary supports to safely secure hoses and nozzles during the test. At the system demand flow, the pressure readings and pressure drop (friction) across the assembly shall be recorded. A metal placard shall be provided on the backflow prevention assembly that lists the pressure readings both upstream and downstream of the assembly, total pressure drop, and the system test flow rate. The pressure drop shall be compared to the manufacturer's data.

##### 3.10.3 Testing of Alarm Devices

Each alarm switch shall be tested by flowing water through the inspector's test connection. Each water-operated alarm devices shall be tested to verify proper operation.

#### 3.10.4 Main Drain Flow Test

Following flushing of the underground piping, a main drain test shall be made to verify the adequacy of the water supply. Static and residual pressures shall be recorded on the certificate specified in paragraph SUBMITTALS. In addition, a main drain test shall be conducted each time after a main control valve is shut and opened.

#### 3.11 FINAL ACCEPTANCE TEST

Final Acceptance Test shall begin only when the Preliminary Test Report has been approved. The Fire Protection Specialist shall conduct the Final Acceptance Test and shall provide a complete demonstration of the operation of the system. This shall include operation of control valves and flowing of inspector's test connections to verify operation of associated waterflow alarm switches. After operation of control valves has been completed, the main drain test shall be repeated to assure that control valves are in the open position. In addition, the representative shall have available copies of as-built drawings and certificates of tests previously conducted. The installation shall not be considered accepted until identified discrepancies have been corrected and test documentation is properly completed and received. The Contractor shall submit the Final Acceptance Test Report as specified in the Submittals paragraph.

#### 3.12 ON-SITE TRAINING

The Fire Protection Specialist shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of 4 hours of normal working time and shall start after the system is functionally complete but prior to the Preliminary Tests and Final Acceptance Test. The On-Site Training shall cover all of the items contained in the approved Operating and Maintenance Instructions.

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## SECTION 14534N

## JIB CRANE WITH MANUAL HOIST

09/99

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

## ASME INTERNATIONAL (ASME)

ASME HST-2	(1989; R 1995) Hand Chain Manually Operated Chain Hoists
ASME HST-3	(1991; R 1996) Manually Lever Operated Chain Hoists

## MONORAIL MANUFACTURERS ASSOCIATION (MMA)

MMA MH27.1	(1981) Underhung Cranes and Monorail Systems
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## 1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

## SD-02 Shop Drawings

Jib crane system; G-DO

Submit drawings showing the general arrangement of the jib crane and hoist system, including clearances, principal dimensions, details of structural connections, and all component details. Manufacturer's catalog data will suffice for items of standard manufacturer.

## SD-10 Operation and Maintenance Data

Hoist and trolley;

Submit Operation and Maintenance Data

## 1.3 QUALITY ASSURANCE

## 1.3.1 Certifications: Load Chain

Submit factory certification of load chain rated capacity.

## 1.3.2 Design Data: Design Calculations

Submit design calculations verifying the size bolts and/or welds to the building column. The calculations shall include stress and loading diagrams. Submit calculations with jib crane drawings.

## PART 2 PRODUCTS

### 2.1 FABRICATION AND CONSTRUCTION

Provide manual hoist and trolley, ASME HST-2, ASME HST-3, trolley suspension. Trolley and wheels shall be suitable for operation on the steel jib beam provided, and shall have not less than four wheels.

#### 2.1.1 Capacity

The hoist and jib and connections to building column shall have a minimum rated capacity of 500 pounds. The load limit of 500 pounds shall be clearly indicated in large lettering on the jib or hoist.

#### 2.1.2 Hook Lift

Hook shall be forged steel; complete with spring-loaded steel throat opening safety device. The hook shall be carried on suitably sealed or shielded anti-friction thrust bearings and shall swivel freely through 360 degrees rotation with full load without twisting chain. The hoist lift shall at a minimum have highest and lowest points as indicated on the drawings.

#### 2.1.3 Trolley

Shall be designed to operate from as close a practical to the building column, to a point over the mezzanine as shown on the drawings.

#### 2.1.4 Load Chain

High strength steel links, flexible; minimum safety factor of 5 to 1 based on ratio of minimum chain breaking load to the calculated load on the chain when the hoist is assumed loaded to rated capacity. Certification from hoist manufacturer of provided chain's breaking strength shall be submitted to Contracting Officer and approved prior to final acceptance of hoist. Do not paint or coat the load chain.

### 2.2 PAINTING OF SYSTEM

The jib crane shall be painted before shipment with a prime and finish coat of a lead-free alkyd air-dry enamel. The finish coat shall be yellow iwth a semi-gloss finish. Do not paint, coat, or galvanize load chain, load, hook nut, or load chain sheave.

## PART 3 EXECUTION

### 3.1 ERECTION AND INSTALLATION

The Contractor shall erect and install the hoist trolley and jib crane system in accordance with manufacturers written instructions, MMA MH27.1, and the contract drawings.

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07/02

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## SECTION 15080A

THERMAL INSULATION FOR MECHANICAL SYSTEMS  
07/02

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. At the discretion of the Government, the manufacturer of any material supplied will be required to furnish test reports pertaining to any of the tests necessary to assure compliance with the standard or standards referenced in this specification.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 167	(1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 580/A 580M	(1998) Stainless Steel Wire
ASTM B 209	(2001) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C 1126	(2000) Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation
ASTM C 1136	(1995) Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM C 1290	(2000e1) Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts
ASTM C 195	(1995) Mineral Fiber Thermal Insulating Cement
ASTM C 449/C 449M	(2000) Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
ASTM C 518	(1998) Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM C 533	(1995; R 2001) Calcium Silicate Block and Pipe Thermal Insulation
ASTM C 534	(2001a) Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
ASTM C 547	(2000) Mineral Fiber Pipe Insulation

ASTM C 552	(2000) Cellular Glass Thermal Insulation
ASTM C 553	(2000) Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 610	(1999) Molded Expanded Perlite Block and Pipe Thermal Insulation
ASTM C 612	(2000a) Mineral Fiber Block and Board Thermal Insulation
ASTM C 647	(1995; R 2000) Properties and Tests of Mastics and Coating Finishes for Thermal Insulation
ASTM C 665	(2001e1) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C 795	(1992; R 1998e1) Thermal Insulation for Use in Contact with Austenitic Stainless Steel
ASTM C 916	(1985; R 1996e1) Adhesives for Duct Thermal Insulation
ASTM C 920	(2002) Elastomeric Joint Sealants
ASTM C 921	(1989; R 1996) Determining the Properties of Jacketing Materials for Thermal Insulation
ASTM E 84	(2001) Surface Burning Characteristics of Building Materials
ASTM E 96	(2000e1) Water Vapor Transmission of Materials

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS  
INDUSTRY (MSS)

MSS SP-69	(1996) Pipe Hangers and Supports - Selection and Application
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MIDWEST INSULATION CONTRACTORS ASSOCIATION (MICA)

MICA Insulation Stds	(1999) National Commercial & Industrial Insulation Standards
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## 1.2 SYSTEM DESCRIPTION

Field-applied insulation and accessories on mechanical systems shall be as specified herein; factory-applied insulation is specified under the piping, duct or equipment to be insulated. Insulation of heat distribution systems and chilled water systems outside of buildings shall be as specified in Section 02552A PRE-ENGINEERED UNDERGROUND HEAT DISTRIBUTION SYSTEM, Section 02553A HEAT DISTRIBUTION SYSTEMS IN CONCRETE TRENCHES, Section 02554A

ABOVEGROUND HEAT DISTRIBUTION SYSTEM, and Section 02555A PREFABRICATED UNDERGROUND HEATING/COOLING DISTRIBUTION SYSTEM. Field applied insulation materials required for use on Government-furnished items as listed in the SPECIAL CONTRACT REQUIREMENTS shall be furnished and installed by the Contractor.

### 1.3 GENERAL QUALITY CONTROL

#### 1.3.1 Standard Products

Materials shall be the standard products of manufacturers regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

#### 1.3.2 Installer's Qualifications

Qualified installers shall have successfully completed three or more similar type jobs within the last 5 years.

#### 1.3.3 Surface Burning Characteristics

Unless otherwise specified, insulation not covered with a jacket shall have a flame spread index no higher than 75 and a smoke developed index no higher than 150. Insulation systems which are located in air plenums, in ceiling spaces, and in attic spaces shall have a flame spread index no higher than 25 and a smoke developed index no higher than 50. Insulation materials located exterior to the building perimeter are not required to be fire-rated. Flame spread, and smoke developed indexes, shall be determined by ASTM E 84. Insulation shall be tested in the same density and installed thickness as the material to be used in the actual construction. Jackets, facings, and adhesives shall have a flame spread index no higher than 25 and a smoke developed index no higher than 50 when tested in accordance with ASTM E 84.

#### 1.3.4 Identification of Materials

Packages or standard containers of insulation, jacket material, cements, adhesives, and coatings delivered for use, and samples required for approval shall have manufacturer's stamp or label attached giving the name of the manufacturer and brand, and a description of the material.

### 1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Mica Plates; G-A0.

After approval of materials and prior to applying insulation, a booklet shall be prepared and submitted for approval. The booklet shall contain marked-up MICA Insulation Stds plates (or detail drawings showing the insulation material and insulating system) for each pipe, duct, or piece of equipment that must be insulated

per this specification. The MICA plates shall be marked up showing the materials to be installed in accordance with the requirements of this specification for the specific insulation application. The Contractor shall submit all MICA Plates required to show the entire insulating system, including Plates required to show insulation penetrations, vessel bottom and top heads, legs, and skirt insulation as applicable. If the Contractor elects to submit detailed drawings instead of marked-up MICA Plates, the detail drawings shall show cut-away, section views, and details indicating each component of the insulation system and showing provisions for insulating jacketing, and sealing portions of the equipment. For each type of insulation installation on the drawings, provide a label that identifies each component in the installation (i.e., the duct, insulation, adhesive, vapor retarder, jacketing, tape, mechanical fasteners, etc.) Indicate insulation by type and manufacturer. Three copies of the booklet shall be submitted at the jobsite to the Contracting Officer. One copy of the approved booklet shall remain with the insulation Contractor's display sample and two copies shall be provided for Government use.

#### SD-03 Product Data

General Materials; G-D0.

A complete list of materials, including manufacturer's descriptive technical literature, performance data, catalog cuts, and installation instructions. The product number, k-value, thickness and furnished accessories for each mechanical system requiring insulation shall be included. Materials furnished under this section of the specification shall be submitted at one time.

#### SD-04 Samples

Thermal Insulation Materials; G-A0.

After approval of materials actual sections of installed systems, properly insulated in accordance with the specification requirements, shall be displayed. Such actual sections must remain accessible to inspection throughout the job and will be reviewed from time to time for controlling the quality of the work throughout the construction site. Each material used shall be identified, by indicating on an attached sheet the specification requirement for the material and the material by each manufacturer intended to meet the requirement. The Contracting Officer will inspect display sample sections at the jobsite. Approved display sample sections shall remain on display at the jobsite during the construction period. Upon completion of construction, the display sample sections will be closed and sealed.

Pipe Insulation Display Sections: Display sample sections shall include as a minimum an elbow or tee, a valve, dielectric waterways and flanges, a hanger with protection shield and insulation insert, or dowel as required, at support point, method of fastening and sealing insulation at longitudinal lap, circumferential lap, butt joints at fittings and on pipe runs, and terminating points for each type of pipe insulation used on the job, and for hot pipelines and cold pipelines, both interior and

exterior, even when the same type of insulation is used for these services.

Duct Insulation Display Sections: Display sample sections for rigid and flexible duct insulation used on the job. A temporary covering shall be used to enclose and protect display sections for duct insulation exposed to weather.

## 1.5 STORAGE

Materials shall be delivered in the manufacturer's unopened containers. Materials delivered and placed in storage shall be provided with protection from weather, humidity, dirt, dust and other contaminants. The Contracting Officer may reject insulation material and supplies that become dirty, dusty, wet, or contaminated by some other means.

## PART 2 PRODUCTS

### 2.1 GENERAL MATERIALS

Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either the wet or dry state. Materials to be used on stainless steel surfaces shall meet ASTM C 795 requirements. Materials shall be asbestos free and conform to the following:

#### 2.1.1 Adhesives

##### 2.1.1.1 Acoustical Lining Insulation Adhesive

Adhesive shall be a nonflammable, fire-resistant adhesive conforming to ASTM C 916, Type I.

##### 2.1.1.2 Mineral Fiber Insulation Cement

Cement shall be in accordance with ASTM C 195.

##### 2.1.1.3 Lagging Adhesive

Lagging is the material used for thermal insulation, especially around a cylindrical object. This may include the insulation as well as the cloth/material covering the insulation. Lagging adhesives shall be nonflammable and fire-resistant and shall have a flame spread rating no higher than 25 and a smoke developed rating no higher than 50 when tested in accordance with ASTM E 84. Adhesive shall be pigmented white and be suitable for bonding fibrous glass cloth to faced and unfaced fibrous glass insulation board; for bonding cotton brattice cloth to faced and unfaced fibrous glass insulation board; for sealing edges of and bonding fibrous glass tape to joints of fibrous glass board; for bonding lagging cloth to thermal insulation; or for attaching fibrous glass insulation to metal surfaces. Lagging adhesives shall be applied in strict accordance with the manufacturer's recommendations.

#### 2.1.2 Contact Adhesive

Adhesives may be dispersed in a volatile organic solvent. Adhesives may be any of, but not limited to, the neoprane based, rubber based, or elastomeric type that have a flame spread index no higher than 25 and a smoke developed index no higher than 50 when tested in the dry state in

accordance with ASTM E 84. The adhesive shall not adversely affect, initially or in service, the insulation to which it is applied, nor shall it cause any corrosive effect on metal to which it is applied. Any solvent dispersing medium or volatile component of the adhesive shall have no objectionable odor and shall not contain any benzene or carbon tetrachloride. The dried adhesive shall not emit nauseous, irritating, or toxic volatile matters or aerosols when the adhesive is heated to any temperature up to 212 degrees F. The dried adhesive shall be nonflammable and fire resistant.

#### 2.1.3 Caulking

ASTM C 920, Type S, Grade NS, Class 25, Use A.

#### 2.1.4 Corner Angles

Nominal 0.016 inch aluminum 1 x 1 inch with factory applied kraft backing. Aluminum shall be ASTM B 209, Alloy 3003, 3105, or 5005.

#### 2.1.5 Finishing Cement

ASTM C 449/C 449M: Mineral fiber hydraulic-setting thermal insulating and finishing cement. All cements that may come in contact with Austenitic stainless steel must include testing per ASTM C 795.

#### 2.1.6 Fibrous Glass Cloth and Glass Tape

Fibrous glass cloth and glass tape shall have flame spread and smoke developed ratings of no greater than 25/50 when measured in accordance with ASTM E 84. Tape shall be 4 inch wide rolls.

#### 2.1.7 Staples

Outward clinching type ASTM A 167, Type 304 or 316 stainless steel. Monel is a nickel rich alloy that has high strength, high ductility, and excellent resistance to corrosion.

#### 2.1.8 Jackets

ASTM C 921, Type I, maximum moisture vapor transmission 0.02 perms, (measured before factory application or installation), minimum puncture resistance 50 Beach units on all surfaces except concealed ductwork, where a minimum puncture resistance of 25 Beach units is acceptable. Minimum tensile strength, 35 pounds/inch width. ASTM C 921, Type II, minimum puncture resistance 25 Beach units, tensile strength minimum 20 pounds/inch width. Jackets used on insulation exposed in finished areas shall have white finish suitable for painting without sizing. Based on the application, insulation materials that require factory applied jackets are mineral fiber, cellular glass, and phenolic foam. All non-metallic jackets shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E 84.

##### 2.1.8.1 White Vapor Retarder All Service Jacket (ASJ)

For use on hot/cold pipes, ducts, or equipment vapor retarder jackets used on insulation exposed in finished areas shall have white finish suitable for painting without sizing.

##### 2.1.8.2 Aluminum Jackets

Aluminum jackets shall be corrugated, embossed or smooth sheet, 0.016 inch nominal thickness; ASTM B 209, Temper H14, Temper H16, Alloy 3003, 5005, or 3105 with factory applied moisture retarder. Corrugated aluminum jacket shall not be used outdoors. Aluminum jacket securing bands shall be Type 304 stainless steel, 0.015 inch thick, 1/2 inch wide for pipe under 12 inch diameter and 3/4 inch wide for pipe over 12 inch and larger diameter. Aluminum jacket circumferential seam bands shall be 2 x 0.016 inch aluminum matching jacket material. Bands for insulation below ground shall be 3/4 x 0.020 inch) thick stainless steel, or fiberglass reinforced tape. The jacket may, at the option of the Contractor, be provided with a factory fabricated Pittsburgh or "Z" type longitudinal joint. When the "Z" joint is used, the bands at the circumferential joints shall be designed by the manufacturer to seal the joints and hold the jacket in place.

#### 2.1.8.3 Polyvinyl Chloride (PVC) Jackets

Polyvinyl chloride (PVC) jacket and fitting covers shall have high impact strength, UV resistant rating or treatment and moderate chemical resistance with minimum thickness 0.030 inch.

#### 2.1.9 Vapor Retarder Required

##### 2.1.9.1 Vapor Retarder Mastic Coatings

The vapor retarder coating shall be fire and water resistant and appropriately selected for either outdoor or indoor service. Color shall be white. The water vapor permeance of the compound shall be determined according to procedure B of ASTM E 96 utilizing apparatus described in ASTM E 96. The coating shall be a nonflammable, fire resistant type. All other application and service properties shall be in accordance with ASTM C 647.

##### 2.1.10 Not Used

##### 2.1.11 Wire

Soft annealed ASTM A 580/A 580M Type 302, 304 or 316 stainless steel, 16 or 18 gauge.

##### 2.1.12 Sealants

Sealants shall be chosen from the butyl polymer type, the styrene-butadiene rubber type, or the butyl type of sealants. Sealants shall have a maximum moisture vapor transmission of 0.02 perms, and a maximum flame spread/smoke developed index of 25/50 per ASTM E 84.

#### 2.2 PIPE INSULATION MATERIALS

Pipe insulation materials shall be limited to those listed herein and shall meet the following requirements:

##### 2.2.1 Aboveground Cold Pipeline

Insulation for minus 30 degrees to plus 60 degrees F for outdoor, indoor, exposed or concealed applications, shall be as follows:

- a. Cellular Glass: ASTM C 552, Type II, and Type III. Supply the insulation with manufacturer's recommended factory-applied jacket.

- b. Flexible Elastomeric Cellular Insulation: ASTM C 534, Type I or II. Type II shall have vapor retarder skin on both sides of the insulation.
- c. Phenolic Insulation: ASTM C 1126, Type III. Phenolic insulations shall comply with ASTM C 795 and with the ASTM C 665 paragraph Corrosiveness. Supply the insulation with manufacturer's recommended factory-applied jacket.

#### 2.2.2 Aboveground Hot Pipeline

Insulation for above 60 degrees F, for outdoor, indoor, exposed or concealed applications shall meet the following requirements. Supply the insulation with manufacturer's recommended factory-applied jacket.

- a. Mineral Fiber: ASTM C 547, Types I, II or III, supply the insulation with manufacturer's recommended factory-applied jacket.
- b. Calcium Silicate: ASTM C 533, Type I indoor only, or outdoors above 250 degrees F pipe temperature. Supply insulation with the manufacturer's recommended factory-applied jacket.
- c. Cellular Glass: ASTM C 552, Type II and Type III. Supply the insulation with manufacturer's recommended factory-applied jacket.
- d. Flexible Elastomeric Cellular Insulation: ASTM C 534, Type I or II to 200 degrees F service.
- e. Phenolic Insulation: ASTM C 1126 Type III to 250 F service shall comply with ASTM C 795. Supply the insulation with manufacturer's recommended factory-applied jacket.
- f. Perlite Insulation: ASTM C 610

#### 2.2.3 Not Used

#### 2.2.4 Not Used

### 2.3 DUCT INSULATION MATERIALS

Duct insulation materials shall be limited to those listed herein and shall meet the following requirements:

#### 2.3.1 Rigid Mineral Fiber

ASTM C 612: Type IA, IB, II, III, & IV.

#### 2.3.2 Flexible Mineral Fiber

ASTM C 553: Type I, or Type II up to 250 F. ASTM C 1290 Type III.

#### 2.3.3 Cellular Glass

ASTM C 552, Type I.

#### 2.3.4 Phenolic Foam

ASTM C 1126: Type II shall comply with ASTM C 795.

2.3.5 Flexible Elastomeric Cellular

ASTM C 534: Type II.

2.4 EQUIPMENT INSULATION MATERIALS

Equipment insulation materials shall be limited to those listed herein and shall meet the following requirements:

2.4.1 Cold Equipment Insulation

For equipment operating temperatures below 60 degrees F.

2.4.1.1 Cellular Glass

ASTM C 552: Type I, Type III, or Type IV as required.

2.4.1.2 Flexible Elastomeric Cellular Insulation

ASTM C 534, Type II.

2.4.1.3 Phenolic Foam

ASTM C 1126: Type II shall comply with ASTM C 795.

2.4.2 Hot Equipment Insulation

For equipment operating temperatures above 60 degrees F.

2.4.2.1 Rigid Mineral Fiber

ASTM C 612: Type IA, IB, II, III, IV, or V as required for temperatures encountered to 1800 degrees F.

2.4.2.2 Flexible Mineral Fiber

ASTM C 553: Type I, II, III, IV, V, VI or VII as required for temperatures encountered to 1200 degrees F.

2.4.2.3 Calcium Silicate

ASTM C 533, Type I, in-doors only, or outdoors above 250 degrees F.

2.4.2.4 Cellular Glass

ASTM C 552: Type I, Type III, or Type IV as required.

2.4.2.5 Flexible Elastomeric Cellular Insulation

ASTM C 534, Type II, to 200 degrees F.

2.4.2.6 Phenolic Foam

ASTM C 1126, Type II, to 250 degrees F shall comply with ASTM C 795.

2.4.2.7 Molded Expanded Perlite

ASTM C 610.

## PART 3 EXECUTION

## 3.1 APPLICATION - GENERAL

Insulation shall only be applied to unheated and uncooled piping and equipment. Flexible elastomeric cellular insulation shall not be compressed at joists, studs, columns, ducts, hangers, etc. The insulation shall not pull apart after a one hour period; any insulation found to pull apart after one hour, shall be replaced.

## 3.1.1 Installation

Except as otherwise specified, material shall be installed in accordance with the manufacturer's written instructions. Insulation materials shall not be applied until tests specified in other sections of this specification are completed. Material such as rust, scale, dirt and moisture shall be removed from surfaces to receive insulation. Insulation shall be kept clean and dry. Insulation shall not be removed from its shipping containers until the day it is ready to use and shall be returned to like containers or equally protected from dirt and moisture at the end of each workday. Insulation that becomes dirty shall be thoroughly cleaned prior to use. If insulation becomes wet or if cleaning does not restore the surfaces to like new condition, the insulation will be rejected, and shall be immediately removed from the jobsite. Joints shall be staggered on multi layer insulation. Mineral fiber thermal insulating cement shall be mixed with demineralized water when used on stainless steel surfaces. Insulation, jacketing and accessories shall be installed in accordance with MICA Insulation Stds plates except where modified herein or on the drawings.

## 3.1.2 Fire-stopping

Where pipes and ducts pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be sealed with fire stopping materials as specified in Section 07840A FIRESTOPPING.

## 3.1.3 Painting and Finishing

Painting shall be as specified in Section 09900 PAINTS AND COATINGS.

## 3.1.4 Installation of Flexible Elastomeric Cellular Insulation

Flexible elastomeric cellular insulation shall be installed with seams and joints sealed with rubberized contact adhesive. Insulation with pre-applied adhesive is not permitted. Flexible elastomeric cellular insulation shall not be used on surfaces greater than 200 degrees F. Seams shall be staggered when applying multiple layers of insulation. Insulation exposed to weather and not shown to have jacketing shall be protected with two coats of UV resistant finish as recommended by the manufacturer after the adhesive is dry. A brush coating of adhesive shall be applied to both butt ends to be joined and to both slit surfaces to be sealed. The adhesive shall be allowed to set until dry to touch but tacky under slight pressure before joining the surfaces. Insulation seals at seams and joints shall not be capable of being pulled apart one hour after application. Insulation that can be pulled apart one hour after installation shall be replaced.

## 3.1.5 Welding

No welding shall be done on piping, duct or equipment without written

approval of the Contracting Officer. The capacitor discharge welding process may be used for securing metal fasteners to duct.

### 3.1.6 Pipes/Ducts/Equipment which Require Insulation

Insulation is required on all pipes, ducts, or equipment, except for omitted items, as specified.

## 3.2 PIPE INSULATION INSTALLATION

### 3.2.1 Pipe Insulation

#### 3.2.1.1 General

Pipe insulation shall be installed on aboveground hot and cold pipeline systems as specified below to form a continuous thermal retarder, including straight runs, fittings and appurtenances unless specified otherwise. Installation shall be with full length units of insulation and using a single cut piece to complete a run. Cut pieces or scraps abutting each other shall not be used. Pipe insulation shall be omitted on the following:

- a. Pipe used solely for fire protection.
- b. Chromium plated pipe to plumbing fixtures. However, fixtures for use by the physically handicapped shall have the hot water supply and drain, including the trap, insulated where exposed.
- c. Sanitary drain lines.
- d. Air chambers.

#### 3.2.1.2 Pipes Passing Through Walls, Roofs, and Floors

- a. Pipe insulation shall be continuous through the sleeve.
- b. An aluminum jacket with factory applied moisture retarder shall be provided over the insulation wherever penetrations require sealing.
- c. Where pipes penetrate interior walls, the aluminum jacket shall extend 2 inches beyond either side of the wall and shall be secured on each end with a band.
- d. Where penetrating floors, the aluminum jacket shall extend from a point below the backup material to a point 10 inches above the floor with one band at the floor and one not more than 1 inch from the end of the aluminum jacket.
- e. Where penetrating waterproofed floors, the aluminum jacket shall extend from below the backup material to a point 2 inches above the flashing with a band 1 inch from the end of the aluminum jacket.
- f. Where penetrating exterior walls, the aluminum jacket required for pipe exposed to weather shall continue through the sleeve to a point 2 inches beyond the interior surface of the wall.
- g. Where penetrating roofs, pipe shall be insulated as required for interior service to a point flush with the top of the flashing and sealed with vapor retarder coating. The insulation for exterior application shall butt tightly to the top of flashing and interior

insulation. The exterior aluminum jacket shall extend 2 inches down beyond the end of the insulation to form a counter flashing. The flashing and counter flashing shall be sealed underneath with caulking.

- h. For hot water pipes supplying lavatories or other similar heated service that requires insulation, the insulation shall be terminated on the backside of the finished wall. The insulation termination shall be protected with two coats of vapor barrier coating with a minimum total thickness of 1/16 inch applied with glass tape embedded between coats (if applicable). The coating shall extend out onto the insulation 2 inches and shall seal the end of the insulation. Glass tape seams shall overlap 1 inch. The annular space between the pipe and wall penetration shall be caulked with approved fire stop material. The pipe and wall penetration shall be covered with a properly sized (well fitting) escutcheon plate. The escutcheon plate shall overlap the wall penetration at least 3/8 inches.
- i. For domestic cold water pipes supplying lavatories or other similar cooling service that requires insulation, the insulation shall be terminated on the finished side of the wall (i.e., insulation must cover the pipe throughout the wall penetration). The insulation shall be protected with two coats of vapor barrier coating with a minimum total thickness of 1/16 inch. The coating shall extend out onto the insulation 2 inches and shall seal the end of the insulation. The annular space between the outer surface of the pipe insulation and the wall penetration shall be caulked with an approved fire stop material having vapor retarder properties. The pipe and wall penetration shall be covered with a properly sized (well fitting) escutcheon plate. The escutcheon plate shall overlap the wall penetration by at least 3/8 inches.

#### 3.2.1.3 Pipes Passing Through Hangers

- a. Insulation, whether hot or cold application, shall be continuous through hangers. All horizontal pipes 2 inches and smaller shall be supported on hangers with the addition of a Type 40 protection shield to protect the insulation in accordance with MSS SP-69. Whenever insulation shows signs of being compressed, or when the insulation or jacket shows visible signs of distortion at or near the support shield, insulation inserts as specified below for piping larger than 2 inches shall be installed.
- b. Horizontal pipes larger than 2 inches at 60 degrees F and above shall be supported on hangers in accordance with MSS SP-69, and Section 15400A PLUMBING, GENERAL PURPOSE.
- c. Horizontal pipes larger than 2 inches and below 60 degrees F shall be supported on hangers with the addition of a Type 40 protection shield in accordance with MSS SP-69. An insulation insert of cellular glass, calcium silicate (or perlite above 80 F), or the necessary strength polyisocyanurate shall be installed above each shield. The insert shall cover not less than the bottom 180-degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 2 inches on each end beyond the protection shield. When insulation inserts are required per the above, and the insulation thickness is less than 1 inch, wooden or cork dowels or blocks may be installed between the pipe

and the shield to prevent the weight of the pipe from crushing the insulation, as an option to installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert.

- d. Vertical pipes shall be supported with either Type 8 or Type 42 riser clamps with the addition of two Type 40 protection shields in accordance with MSS SP-69 covering the 360-degree arc of the insulation. An insulation insert of cellular glass or calcium silicate shall be installed between each shield and the pipe. The insert shall cover the 360-degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 2 inches on each end beyond the protection shield. When insulation inserts are required per the above, and the insulation thickness is less than 1 inch, wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the hanger from crushing the insulation, as an option instead of installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert. The vertical weight of the pipe shall be supported with hangers located in a horizontal section of the pipe. When the pipe riser is longer than 30 feet, the weight of the pipe shall be additionally supported with hangers in the vertical run of the pipe that are directly clamped to the pipe, penetrating the pipe insulation. These hangers shall be insulated and the insulation jacket sealed as indicated herein for anchors in a similar service.
- e. Inserts shall be covered with a jacket material of the same appearance and quality as the adjoining pipe insulation jacket, shall overlap the adjoining pipe jacket 1-1/2 inches, and shall be sealed as required for the pipe jacket. The jacket material used to cover inserts in flexible elastomeric cellular insulation shall conform to ASTM C 1136, Type 1, and is allowed to be of a different material than the adjoining insulation material.

#### 3.2.1.4 Flexible Elastomeric Cellular Pipe Insulation

Flexible elastomeric cellular pipe insulation shall be tubular form for pipe sizes 6 inches and less. Type II sheet insulation used on pipes larger than 6 inches shall not be stretched around the pipe. On pipes larger than 12 inches, the insulation shall be adhered directly to the pipe on the lower 1/3 of the pipe. Seams shall be staggered when applying multiple layers of insulation. Sweat fittings shall be insulated with miter-cut pieces the same size as on adjacent piping. Screwed fittings shall be insulated with sleeved fitting covers fabricated from miter-cut pieces and shall be overlapped and sealed to the adjacent pipe insulation.

#### 3.2.1.5 Pipes In High Abuse Areas

In high abuse areas such as janitor closets and traffic areas in equipment rooms, vehicle bays, fish production areas, loading docks, and mechanical rooms, aluminum jackets shall be utilized. Pipe insulation to the 6 foot level shall be protected.

#### 3.2.2 Aboveground Cold Pipelines

The following cold pipelines shall be insulated per Table I minus 30 degrees to plus 60 degrees F:

- a. Domestic cold and chilled drinking water.
- b. Make-up water.
- c. Not Used.
- d. Refrigerant suction lines.
- e. Not Used.
- f. Dual temperature water, i.e. HVAC hot/chilled water.
- g. Air conditioner condensate drains.
- h. Not Used.
- i. Exposed lavatory drains and domestic water lines serving plumbing fixtures for handicap persons.

### 3.2.2.1 Insulation Thickness

Insulation thickness for cold pipelines shall be determined using Table I.

Table I - Cold Piping Insulation Thickness  
Pipe Size (inches)

Type of Service	Material	Run-outs up to 2 in*	1 in & less	1.25 - 2 in	2.5 - 4 in	5 - 6 in	8 in & larger
Refrigerant suction piping	CG		1.5	1.5	1.5	1.5	1.5
	FC		1.0	1.0	1.0	1.0	1.0
	PF		1.5	1.5	1.5	1.5	1.5
	PC		1.0	1.0	1.0	1.0	1.0
Cold domestic water, above and below ceilings & makeup water	CG	1.5	1.5	1.5	1.5	1.5	1.5
	FC	3/8	3/8	3/8	3/8	3/8	3/8
	PF	1.5	1.5	1.5	1.5	1.5	1.5
	PC	1.0	1.0	1.0	1.0	1.0	1.0

\*When run-outs to terminal units exceed 12 feet, the entire length of run-out shall be insulated like main feed pipe. Insulations may not be applied if their flame and smoke developed ratings exceed the requirements of 25/50 established in this guide specification. Layered insulations, or installation where multiple layers of the same insulation are used, must be checked for this (in particular if the insulation has been rated per ASTM E 84 for one thickness).

#### LEGEND:

PF - Phenolic Foam  
CG - Cellular Glass  
MF - Mineral Fiber

FC - Flexible Elastomeric Cellular

### 3.2.2.2 Jacket for Insulated Pipe

Insulation shall be covered with a factory applied vapor retarder jacket or field applied seal welded PVC jacket. Insulation inside the building, where protected with aluminum jackets, shall have the insulation and vapor retarder jacket installed as specified herein. The aluminum jacket shall be installed as specified for piping exposed to weather, except sealing of the laps of the aluminum jacket is not required. In high abuse areas such as janitor closets and traffic areas in equipment rooms, kitchens, and mechanical rooms, aluminum jackets shall be utilized. Pipe insulation to the 6 ft level shall be protected.

### 3.2.2.3 Insulation for Straight Runs

- a. Insulation shall be applied to the pipe with joints tightly butted. All butted joints and ends shall be sealed with joint sealant and sealed with a vapor retarder coating or PVDC adhesive tape.
- b. Longitudinal laps of the jacket material shall overlap not less than 1-1/2 inches. Butt strips 3 inches wide shall be provided for circumferential joints.
- c. Laps and butt strips shall be secured with adhesive and stapled on 4 inch centers if not factory self-sealing. If staples are used, they shall be sealed per item "e." below. Note that staples are not required with cellular glass systems.
- d. Factory self-sealing lap systems may be used when the ambient temperature is between 40 degrees and 120 degrees F during installation. The lap system shall be installed in accordance with manufacturer's recommendations. Stapler shall be used only if specifically recommended by the manufacturer. Where gaps occur, the section shall be replaced or the gap repaired by applying adhesive under the lap and then stapling.
- e. All Staples, including those used to repair factory self-seal lap systems, shall be coated with a vapor retarder coating or PVDC adhesive tape. All seams, except those on factory self-seal systems shall be coated with vapor retarder coating or PVDC adhesive tape.
- f. Breaks and punctures in the jacket material shall be patched by wrapping a strip of jacket material around the pipe and securing it with adhesive, stapling, and coating with vapor retarder coating or PVDC adhesive tape. The patch shall extend not less than 1-1/2 inches past the break.
- g. At penetrations such as thermometers, the voids in the insulation shall be filled and sealed with vapor retarder coating or PVDC adhesive tape.

### 3.2.2.4 Insulation for Fittings and Accessories

- a. Pipe insulation shall be tightly butted to the insulation of the fittings and accessories. The butted joints and ends shall be sealed with joint sealant and sealed with a vapor retarder coating

or PVDC adhesive tape.

- b. Precut or preformed insulation shall be placed around all fittings and accessories and shall conform to MICA plates except as modified herein: 5 for anchors; 10, 11, and 13 for fittings; 14 for valves; and 17 for flanges and unions. Insulation shall be the same insulation as the pipe insulation, including same density, thickness, and thermal conductivity. Where precut/preformed is unavailable, rigid preformed pipe insulation sections may be segmented into the shape required. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used. If nesting size insulation is used, the insulation shall be overlapped 2 inches or one pipe diameter. Elbows insulated using segments shall conform to MICA Tables 12.20 "Mitered Insulation Elbow".
- c. Upon completion of insulation installation on flanges, unions, valves, anchors, fittings and accessories, terminations, seams, joints and insulation not protected by factory vapor retarder jackets or PVC fitting covers shall be protected with PVDC adhesive tape or two coats of vapor retarder coating with a minimum total thickness of 1/16 inch, applied with glass tape embedded between coats. Tape seams shall overlap 1 inch. The coating shall extend out onto the adjoining pipe insulation 2 inches. Fabricated insulation with a factory vapor retarder jacket shall be protected with PVDC adhesive tape or two coats of vapor retarder coating with a minimum thickness of 1/16 inch and with a 2 inch wide glass tape embedded between coats. Where fitting insulation butts to pipe insulation, the joints shall be sealed with a vapor retarder coating and a 4 inch wide ASJ tape which matches the jacket of the pipe insulation.
- d. Anchors attached directly to the pipe shall be insulated for a sufficient distance to prevent condensation but not less than 6 inches from the insulation surface.
- e. Insulation shall be marked showing the location of unions, strainers, and check valves.

#### 3.2.2.5 Optional PVC Fitting Covers

At the option of the Contractor, premolded, one or two piece PVC fitting covers may be used in lieu of the vapor retarder and embedded glass tape. Factory precut or premolded insulation segments shall be used under the fitting covers for elbows. Insulation segments shall be the same insulation as the pipe insulation including same density, thickness, and thermal conductivity. The covers shall be secured by PVC vapor retarder tape, adhesive, seal welding or with tacks made for securing PVC covers. Seams in the cover, and tacks and laps to adjoining pipe insulation jacket, shall be sealed with vapor retarder tape to ensure that the assembly has a continuous vapor seal.

#### 3.2.3 Aboveground Hot Pipelines

The following hot pipelines above 60 degrees F shall be insulated per Table II:

- a. Domestic hot water supply & re-circulating system.

- b. Steam.
- c. Condensate & compressed air discharge.
- d. Hot water heating.
- e. Heated oil.
- f. Water defrost lines in refrigerated rooms.

### 3.2.3.1 Insulation Thickness

Insulation thickness for hot pipelines shall be determined using Table II.

#### LEGEND:

PF - Phenolic Foam  
 CG - Cellular Glass  
 CS - Calcium Silicate  
 MF - Mineral Fiber  
 FC - Flexible Elastomeric Cellular  
 PL - Perlite  
 PC - Polyisocyanurate Foam

Table II - Hot Piping Insulation Thickness  
 Pipe Size (inches)

Type of Service (degrees F)	Material	Run-outs up to 2 in *	1 in & less	1.25 - 2 in	2.5 - 4 in	5 - 6 in	8 in & larger
Hot domestic water supply & re-circulating system, & water defrost lines (200 F max)**	CG	1.5	1.5	1.5	1.5	1.5	1.5
	FC	0.5	0.5	1.0	1.0	1.5	1.5
	PF	0.5	0.5	1.0	1.0	1.0	1.0
	MF	0.5	1.5	1.5	1.5	1.5	1.5
	PC	1.0	1.0	1.0	1.0	1.0	1.0
Heating hot water, supply & return, & Heating oil (250 F max)	CG	1.5	1.5	2.0	2.0	2.5	3.0
	PF	0.5	1.0	1.0	1.0	1.0	1.5
	MF	0.5	1.5	1.5	2.0	2.5	3.0
	CS	1.0	1.5	2.0	2.5	2.5	3.0
	PC	1.0	1.0	1.0	1.0	1.0	1.0

\* When run-outs to terminal units exceed 12 feet, the entire length of run-out shall be insulated like the main feed pipe.

\*\* Applies to re-circulating sections of service or domestic hot water systems and first 8 feet from storage tank for non-re-circulating systems.

### 3.2.3.2 Jacket for Insulated Hot Pipe, Except Pipe Insulated with Flexible Elastomeric Cellular

Insulation shall be covered, in accordance with manufacturer's recommendations, with a factory applied Type II jacket or field applied aluminum where required or seal welded PVC.

#### 3.2.3.3 Insulation for Straight Runs

- a. Insulation shall be applied to the pipe with joints tightly butted.
- b. Longitudinal laps of the jacket material shall overlap not less than 1-1/2 inches, and butt strips 3 inches wide shall be provided for circumferential joints.
- c. Laps and butt strips shall be secured with adhesive and stapled on 4 inch centers if not factory self-sealing. Adhesive may be omitted where pipe is concealed.
- d. Factory self-sealing lap systems may be used when the ambient temperature is between 40 degrees and 120 degrees F and shall be installed in accordance with manufacturer's instructions. Laps and butt strips shall be stapled whenever there is non-adhesion of the system. Where gaps occur, the section shall be replaced or the gap repaired by applying adhesive under the lap and then stapling.
- e. Breaks and punctures in the jacket material shall be patched by either wrapping a strip of jacket material around the pipe and securing with adhesive and staple on 4 inch centers (if not factory self-sealing), or patching with tape and sealing with a brush coat of vapor retarder coating. Adhesive may be omitted where pipe is concealed. Patch shall extend not less than 1-1/2 inches past the break.
- f. Installation of flexible elastomeric cellular pipe insulation shall be by slitting the tubular sections and applying them onto the piping or tubing. Alternately, whenever possible slide un-slit sections over the open ends of piping or tubing. All seams and butt joints shall be secured and sealed with adhesive. When using self seal products only the butt joints shall be secured with adhesive. Insulation shall be pushed on the pipe, never pulled. Stretching of insulation may result in open seams and joints. All edges shall be clean cut. Rough or jagged edges of the insulation shall not be permitted. Proper tools such as sharp knives shall be used. Type II sheet insulation when used on pipe larger than 6 inches shall not be stretched around the pipe. On pipes larger than 12 inches, adhere sheet insulation directly to the pipe on the lower 1/3 of the pipe.

#### 3.2.3.4 Insulation for Fittings and Accessories

- a. Pipe insulation shall be tightly butted to the insulation of the fittings and accessories.
- b. Precut or preformed insulation shall be placed around all fittings and accessories and shall conform to MICA plates, except as modified herein: 5 for anchors; 10, 11, 12, and 13 for fittings; 14, 15 and 16 for valves; 17 for flanges and unions; and 18 for couplings. Insulation shall be the same as the pipe insulation, including same density, thickness, and thermal conductivity. Where precut/preformed is unavailable, rigid preformed pipe

insulation sections may be segmented into the shape required. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used. If nesting size insulation is used, the insulation shall be overlapped 2 inches or one pipe diameter. Elbows insulated using segments shall conform to MICA Tables 12.20 "Mitered Insulation Elbow".

- c. Upon completion of installation of insulation on flanges, unions, valves, anchors, fittings and accessories, terminations and insulation not protected by factory jackets or PVC fitting covers shall be protected with two coats of adhesive applied with glass tape embedded between coats. Tape seams shall overlap 1 inch. Adhesive shall extend onto the adjoining insulation not less than 2 inches. The total dry film thickness shall be not less than 1/16 inch.
- d. Insulation terminations shall be tapered to unions at a 45-degree angle.
- e. At the option of the Contractor, factory pre-molded one- or two-piece PVC fitting covers may be used in lieu of the adhesive and embedded glass tape. Factory pre-molded segments or factory or field cut blanket insert insulation segments shall be used under the cover and shall be the same thickness as adjoining pipe insulation. The covers shall be secured by PVC vapor retarder tape, adhesive, seal welding or with tacks made for securing PVC covers.

#### 3.2.4 Piping Exposed to Weather

Piping exposed to weather shall be insulated and jacketed as specified for the applicable service inside the building. After this procedure, an aluminum jacket or PVC jacket shall be applied. PVC jacketing requires no factory-applied jacket beneath it, however an all service jacket shall be applied if factory applied jacketing is not furnished. Flexible elastomeric cellular insulation exposed to weather shall be treated in accordance with paragraph INSTALLATION OF FLEXIBLE ELASTOMERIC CELLULAR INSULATION.

##### 3.2.4.1 Aluminum Jacket

The jacket for hot piping may be factory applied. The jacket shall overlap not less than 2 inches at longitudinal and circumferential joints and shall be secured with bands at not more than 12 inch centers. Longitudinal joints shall be overlapped down to shed water and located at 4 or 8 o'clock positions. Joints on piping 60 degrees F and below shall be sealed with caulking while overlapping to prevent moisture penetration. Where jacketing on piping 60 degrees F and below abuts an un-insulated surface, joints shall be caulked to prevent moisture penetration. Joints on piping above 60 degrees F shall be sealed with a moisture retarder.

##### 3.2.4.2 Insulation for Fittings

Flanges, unions, valves, fittings, and accessories shall be insulated and finished as specified for the applicable service. Two coats of breather emulsion type weatherproof mastic (impermeable to water, permeable to air) recommended by the insulation manufacturer shall be applied with glass tape embedded between coats. Tape overlaps shall be not less than 1 inch and the adjoining aluminum jacket not less than 2 inches. Factory preformed

aluminum jackets may be used in lieu of the above. Molded PVC fitting covers shall be provided when PVC jackets are used for straight runs of pipe. PVC fitting covers shall have adhesive welded joints and shall be weatherproof.

3.2.4.3 Not Used.

3.2.5 Not Used

### 3.3 DUCT INSULATION INSTALLATION

Corner angles shall be installed on external corners of insulation on ductwork in exposed finished spaces before covering with jacket. Duct insulation shall be provided unless indicated otherwise on the drawings or in these specifications.

#### 3.3.1 Duct Insulation Thickness

Duct insulation thickness shall be in accordance with Table III.

Table III - Minimum Duct Insulation (inches)

Cold Air Ducts	2.0
Relief Ducts	1.5
Fresh Air Intake Ducts	1.5
Warm Air Ducts	2.0
Relief Ducts	1.5
Fresh Air Intake Ducts	1.5

Maximum thickness for flexible elastomeric cellular insulation shall not exceed 1 inch to comply with ASTM E 84 flame spread/smoke developed ratings of 25/50.

#### 3.3.2 Insulation and Vapor Retarder for Cold Air Duct

Insulation and vapor retarder shall be provided for the following cold air ducts and associated equipment.

- a. Supply ducts.
- b. Return air ducts (in mechanical rooms only).
- c. Relief ducts.
- d. Flexible run-outs (field-insulated).
- e. Not Used.
- f. Not Used.
- g. Not Used.
- h. Not Used.
- i. Fresh air intake ducts.

- j. Filter boxes.
- k. Mixing boxes (field-insulated).
- l. Supply fans (field-insulated).
- m. Site-erected air conditioner casings.
- n. Not Used.
- o. Not Used.

Insulation for rectangular ducts shall be flexible type where concealed, minimum density 3/4 pcf and rigid type where exposed, minimum density 3 pcf.

Insulation for round/oval ducts shall be flexible type, minimum density 3/4 pcf with a factory Type I or II jacket; or, a semi rigid board, minimum density 3 pcf, formed or fabricated to a tight fit, edges beveled and joints tightly butted and staggered, with a factory applied Type I or II all service jacket. Insulation for exposed ducts shall be provided with either a white, paint-able, factory-applied Type I jacket or a vapor retarder jacket coating finish as specified. Insulation on concealed duct shall be provided with a factory-applied Type I or II vapor retarder jacket. The total dry film thickness shall be approximately 1/16 inch.. Duct insulation shall be continuous through sleeves and prepared openings except firewall penetrations. Duct insulation terminating at fire dampers, shall be continuous over the damper collar and retaining angle of fire dampers, which are exposed to unconditioned air and which may be prone to condensate formation. Duct insulation and vapor retarder shall cover the collar, neck, and any un-insulated surfaces of diffusers, registers and grills. Vapor retarder materials shall be applied to form a complete unbroken vapor seal over the insulation. Sheet Metal Duct shall be sealed in accordance with Section 15895A AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

#### 3.3.2.1 Installation on Concealed Duct

- a. For rectangular, oval or round ducts, insulation shall be attached by applying adhesive around the entire perimeter of the duct in 6 inch wide strips on 12 inch centers.
- b. For rectangular and oval ducts, 24 inches and larger insulation shall be additionally secured to bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 16 inch centers and not more than 16 inches from duct corners.
- c. For rectangular, oval and round ducts, mechanical fasteners shall be provided on sides of duct risers for all duct sizes. Fasteners shall be spaced on 16 inch centers and not more than 16 inches from duct corners.
- d. Insulation shall be impaled on the mechanical fasteners (self stick pins) where used and shall be pressed thoroughly into the adhesive. Care shall be taken to ensure vapor retarder jacket joints overlap 2 inches. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type duct hangers.
- e. Self-locking washers shall be installed where mechanical fasteners are used. The pin shall be trimmed back and bent over.

- f. Jacket overlaps shall be secured with staples and tape as necessary to ensure a secure seal. Staples, tape and seams shall be coated with a brush coat of vapor retarder coating or PVDC adhesive tape.
- g. Breaks in the jacket material shall be covered with patches of the same material as the vapor retarder jacket. The patches shall extend not less than 2 inches beyond the break or penetration in all directions and shall be secured with tape and staples. Staples and tape joints shall be sealed with a brush coat of vapor retarder coating or PVDC adhesive tape.
- h. At jacket penetrations such as hangers, thermometers, and damper operating rods, voids in the insulation shall be filled and the penetration sealed with a brush coat of vapor retarder coating or PVDC adhesive tape.
- i. Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor retarder coating finish or tape with a brush coat of vapor retarder coating. The coating shall overlap the adjoining insulation and un-insulated surface 2 inches. Pin puncture coatings shall extend 2 inches from the puncture in all directions.
- j. Where insulation standoff brackets occur, insulation shall be extended under the bracket and the jacket terminated at the bracket.

#### 3.3.2.2 Installation on Exposed Duct Work

- a. For rectangular ducts, rigid insulation shall be secured to the duct by mechanical fasteners on all four sides of the duct, spaced not more than 12 inches apart and not more than 3 inches from the edges of the insulation joints. A minimum of two rows of fasteners shall be provided for each side of duct 12 inches and larger. One row shall be provided for each side of duct less than 12 inches.
- b. Duct insulation shall be formed with minimum jacket seams. Each piece of rigid insulation shall be fastened to the duct using mechanical fasteners. When the height of projections is less than the insulation thickness, insulation shall be brought up to standing seams, reinforcing, and other vertical projections and shall not be carried over. Vapor retarder jacket shall be continuous across seams, reinforcing, and projections. When height of projections is greater than the insulation thickness, insulation and jacket shall be carried over.
- c. Insulation shall be impaled on the fasteners; self-locking washers shall be installed and the pin trimmed or bent over.
- d. Joints in the insulation jacket shall be sealed with a 4 inchwide strip of tape. Tape seams shall be sealed with a brush coat of vapor retarder coating.
- e. Breaks and ribs or standing seam penetrations in the jacket material shall be covered with a patch of the same material as the jacket. Patches shall extend not less than 2 inches beyond the

break or penetration and shall be secured with tape and stapled. Staples and joints shall be sealed with a brush coat of vapor retarder coating.

- f. At jacket penetrations such as hangers, thermometers, and damper operating rods, the voids in the insulation shall be filled and the penetrations sealed with a brush coat of vapor retarder coating.
- g. Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor retarder coating finish. The coating shall overlap the adjoining insulation and un-insulated surface 2 inches. Pin puncture coatings shall extend 2 inches from the puncture in all directions.
- h. Oval and round ducts, flexible type, shall be insulated with factory Type I jacket insulation with minimum density of 3/4 pcf, attached as per MICA standards.

### 3.3.3 Not Used

### 3.3.4 Ducts Handling Air for Dual Purpose

For air handling ducts for dual purpose below and above 60 degrees F, ducts shall be insulated as specified for cold air duct.

### 3.3.5 Insulation for Evaporative Cooling Duct

Evaporative cooling supply duct located in spaces not evaporatively cooled, shall be insulated. Material and installation requirements shall be as specified for duct insulation for warm air duct.

### 3.3.6 Duct Test Holes

After duct systems have been tested, adjusted, and balanced, breaks in the insulation and jacket shall be repaired in accordance with the applicable section of this specification for the type of duct insulation to be repaired.

### 3.3.7 Not Used

## 3.4 EQUIPMENT INSULATION INSTALLATION

### 3.4.1 General

Removable insulation sections shall be provided to cover parts of equipment that must be opened periodically for maintenance including vessel covers, fasteners, flanges and accessories. Equipment insulation shall be omitted on the following:

- a. Hand-holes.
- b. Boiler manholes.
- c. Cleanouts.
- d. ASME stamps.
- e. Manufacturer's nameplates.

### 3.4.2 Insulation for Cold Equipment

Cold equipment below 60 degrees F: Insulation shall be furnished on equipment handling media below 60 degrees F including the following:

- a. Pumps.
- b. Refrigeration equipment parts that are not factory insulated.
- c. Drip pans under chilled equipment.
- d. Duct mounted coils.
- e. Not Used.
- f. Not Used.
- g. Not Used.
- h. Heat pump equipment parts that are not factory insulated.
- i. Expansion and air separation tanks.

#### 3.4.2.1 Insulation Type

Insulation shall be suitable for the temperature encountered. Thicknesses shall be as follows:

- a. Equipment handling media between 35 and 60 degrees F: 1.5 inch thick cellular glass, 1 inch thick flexible elastomeric cellular, 1.5 inch thick phenolic foam, or 1 inch thick polyisocyanurate foam.

#### 3.4.2.2 Pump Insulation

- a. Insulate pumps by forming a box around the pump housing. The box shall be constructed by forming the bottom and sides using joints that do not leave raw ends of insulation exposed. Joints between sides and between sides and bottom shall be joined by adhesive with lap strips for rigid mineral fiber and contact adhesive for flexible elastomeric cellular insulation. The box shall conform to the requirements of MICA Insulation Stds plate No. 49 when using flexible elastomeric cellular insulation. Joints between top cover and sides shall fit tightly forming a female shiplap joint on the side pieces and a male joint on the top cover, thus making the top cover removable.
- b. Exposed insulation corners shall be protected with corner angles.
- c. Upon completion of installation of the insulation, including removable sections, two coats of vapor retarder coating shall be applied with a layer of glass cloth embedded between the coats. The total dry thickness of the finish shall be 1/16 inch. A parting line shall be provided between the box and the removable sections allowing the removable sections to be removed without disturbing the insulation coating. Caulking shall be applied to parting line, between equipment and removable section insulation, and at all penetrations.

### 3.4.2.3 Other Equipment

- a. Insulation shall be formed or fabricated to fit the equipment. To ensure a tight fit on round equipment, edges shall be beveled and joints shall be tightly butted and staggered.
- b. Insulation shall be secured in place with bands or wires at intervals as recommended by the manufacturer but not more than 12 inch centers except flexible elastomeric cellular which shall be adhered. Insulation corners shall be protected under wires and bands with suitable corner angles.
- c. Phenolic foam insulation shall be set in a coating of bedding compound and joints shall be sealed with bedding compound as recommended by the manufacturer. Cellular glass shall be installed in accordance with manufacturer's instructions. Joints and ends shall be sealed with joint sealant, and sealed with a vapor retarder coating.
- d. Insulation on heads of heat exchangers shall be removable. Removable section joints shall be fabricated using a male-female shiplap type joint. The entire surface of the removable section shall be finished by applying two coats of vapor retarder coating with a layer of glass cloth embedded between the coats. The total dry thickness of the finish shall be 1/16 inch.
- e. Exposed insulation corners shall be protected with corner angles.
- f. Insulation on equipment with ribs shall be applied over 6 x 6 inches by 12 gauge welded wire fabric which has been cinched in place, or if approved by the Contracting Officer, spot welded to the equipment over the ribs. Insulation shall be secured to the fabric with J-hooks and 2 x 2 inch washers or shall be securely banded or wired in place on 12 inch centers.

### 3.4.2.4 Vapor Retarder

Upon completion of installation of insulation, penetrations shall be caulked. Two coats of vapor retarder coating shall be applied over insulation, including removable sections, with a layer of open mesh synthetic fabric embedded between the coats. The total dry thickness of the finish shall be 1/16 inch. Caulking shall be applied to parting line between equipment and removable section insulation.

### 3.4.3 Insulation for Hot Equipment

Insulation shall be furnished on equipment handling media above 60 degrees F including the following:

- a. Heat exchangers.
- b. Hot water generators.
- c. Water heaters.
- d. Pumps handling media above 130 degrees F.
- e. Not Used.

- f. Air separation tanks.
- g. Not Used.
- h. Not Used.
- j. Unjacketed boilers or parts of boilers.
- k. Boiler flue gas connection from boiler to stack (if inside).
- l. Not Used.

#### 3.4.3.1 Insulation

Insulation shall be suitable for the temperature encountered. Shell and tube-type heat exchangers shall be insulated for the temperature of the shell medium.

Insulation thickness for hot equipment shall be determined using Table IV:

#### Legend

RMF: Rigid Mineral Fiber  
 FMF: Flexible Mineral Fiber  
 CS: Calcium Silicate  
 PL: Perlite  
 CG: Cellular Glass  
 FC: Flexible Elastomeric Cellular  
 PF: Phenolic Foam

TABLE IV  
 Insulation Thickness for Hot Equipment (Inches)

Equipment handling steam or media to indicated pressure or temperature limit:	Material	Thickness
15 psig or 250F	RMF	2.0 inches
	FMF	2.0 inches
	CS/PL	4.0 inches
	CG	3.0 inches
	PF	1.5 inches
	FC (<200F)	1.0 inches
200 psig or 400 F	PC	1.0 inches
	RMF	3.0 inches
	FMF	3.0 inches
	CS/PL	4.0 inches
600 F	CG	4.0 inches
	RMF	5.0 inches
	FMF	6.0 inches
	CS/PL	6.0 inches
>600 F: Thickness necessary to limit the external temperature of the insulation to 120F, except that diesel engine exhaust piping and mufflers	CG	6.0 inches

shall be covered with 6.0 inch thick material suitable for 1200 degrees F service. Heat transfer calculations shall be submitted to substantiate insulation and thickness selection.

#### 3.4.3.2 Insulation of Pumps

Insulate pumps by forming a box around the pump housing. The box shall be constructed by forming the bottom and sides using joints that do not leave raw ends of insulation exposed. Bottom and sides shall be banded to form a rigid housing that does not rest on the pump. Joints between top cover and sides shall fit tightly. The top cover shall have a joint forming a female shiplap joint on the side pieces and a male joint on the top cover, making the top cover removable. Two coats of Class I adhesive shall be applied over insulation, including removable sections, with a layer of glass cloth embedded between the coats. A parting line shall be provided between the box and the removable sections allowing the removable sections to be removed without disturbing the insulation coating. The total dry thickness of the finish shall be 1/16 inch. Caulking shall be applied to parting line of the removable sections and penetrations.

#### 3.4.3.3 Other Equipment

- a. Insulation shall be formed or fabricated to fit the equipment. To ensure a tight fit on round equipment, edges shall be beveled and joints shall be tightly butted and staggered.
- b. Insulation shall be secured in place with bands or wires at intervals as recommended by the manufacturer but not greater than 12 inch centers except flexible elastomeric cellular which shall be adhered. Insulation corners shall be protected under wires and bands with suitable corner angles.
- c. On high vibration equipment, cellular glass insulation shall be set in a coating of bedding compound as recommended by the manufacturer, and joints shall be sealed with bedding compound. Mineral fiber joints shall be filled with finishing cement.
- d. Insulation on heads of heat exchangers shall be removable. The removable section joint shall be fabricated using a male-female shiplap type joint. Entire surface of the removable section shall be finished as specified.
- e. Exposed insulation corners shall be protected with corner angles.
- f. On equipment with ribs, such as boiler flue gas connection, draft fans, and fly ash or soot collectors, insulation shall be applied over 6 x 6 inch by 12 gauge welded wire fabric which has been cinched in place, or if approved by the Contracting Officer, spot welded to the equipment over the ribs. Insulation shall be secured to the fabric with J-hooks and 2 x 2 inch washers or shall be securely banded or wired in place on 12 inch (maximum) centers.
- g. On equipment handling media above 600 degrees F, insulation shall be applied in two or more layers with joints staggered.
- h. Upon completion of installation of insulation, penetrations shall be caulked. Two coats of adhesive shall be applied over insulation, including removable sections, with a layer of glass cloth embedded between the coats. The total dry thickness of the

finish shall be 1/16 inch. Caulking shall be applied to parting line between equipment and removable section insulation.

#### 3.4.4 Equipment Handling Dual Temperature Media

Below and above 60 degrees F: equipment handling dual temperature media shall be insulated as specified for cold equipment.

#### 3.4.5 Equipment Exposed to Weather

##### 3.4.5.1 Installation

Equipment exposed to weather shall be insulated and finished in accordance with the requirements for ducts exposed to weather in paragraph DUCT INSULATION INSTALLATION.

##### 3.4.5.2 Optional Panels

At the option of the Contractor, prefabricated metal insulation panels may be used in lieu of the insulation and finish previously specified. Thermal performance shall be equal to or better than that specified for field applied insulation. Panels shall be the standard catalog product of a manufacturer of metal insulation panels. Fastenings, flashing, and support system shall conform to published recommendations of the manufacturer for weatherproof installation and shall prevent moisture from entering the insulation. Panels shall be designed to accommodate thermal expansion and to support a 250 pound walking load without permanent deformation or permanent damage to the insulation. Exterior metal cover sheet shall be aluminum and exposed fastenings shall be stainless steel or aluminum.

-- End of Section --

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## SECTION 15190A

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## SECTION 15190A

## GAS PIPING SYSTEMS

12/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN GAS ASSOCIATION (AGA)

AGA Manual (1994; Addenda/Correction Jan 1996) A.G.A.  
Plastic Pipe Manual for Gas Service

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.45 (1995) Flexible Connectors of Other Than  
All-Metal Construction for Gas Appliances

ANSI Z21.69 (1999) Connectors for Movable Gas  
Appliances

## AMERICAN PETROLEUM INSTITUTE (API)

API Spec 6D (1994; Supple 1 Jun 1996; Supple 2 Dec  
1997) Pipeline Valves (Gate, Plug, Ball,  
and Check Valves)

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 539 (1999) Electric-Resistance-Welded Coiled  
Steel Tubing for Gas and Fuel Oil Lines

ASTM B 210 (2000) Aluminum and Aluminum-Alloy Drawn  
Seamless Tubes

ASTM B 210M (2000) Aluminum and Aluminum-Alloy Drawn  
Seamless Tubes (Metric)

ASTM B 241/B 241M (2000) Aluminum and Aluminum-Alloy  
Seamless Pipe and Seamless Extruded Tube

ASTM B 280 (1999) Seamless Copper Tube for Air  
Conditioning and Refrigeration Field  
Service

ASTM B 88 (1999) Seamless Copper Water Tube

ASTM B 88M (1999) Seamless Copper Water Tube (Metric)

ASTM D 2513 (2000) Thermoplastic Gas Pressure Pipe,  
Tubing, and Fittings

ASTM D 2517 (2000) Reinforced Epoxy Resin Gas Pressure Pipe and Fittings

ASME INTERNATIONAL (ASME)

ASME B1.20.1 (1983; R 1992) Pipe Threads, General Purpose (Inch)

ASME B16.11 (1996) Forged Fittings, Socket-Welding and Threaded

ASME B16.21 (1992) Nonmetallic Flat Gaskets for Pipe Flanges

ASME B16.3 (1998) Malleable Iron Threaded Fittings

ASME B16.33 (1990) Manually Operated Metallic Gas Valves for Use in Gas Piping Systems Up to 125 psig (Sizes 1/2 through 2

ASME B16.5 (1996; B16.5a) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24

ASME B16.9 (1993) Factory-Made Wrought Steel Buttwelding Fittings

ASME B31.1 (1998) Power Piping

ASME B31.2 (1968) Fuel Gas Piping

ASME B36.10M (1996) Welded and Seamless Wrought Steel Pipe

ASME BPVC SEC IX (1998) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-25 (1998) Standard Marking System for Valves, Fittings, Flanges and Unions

MSS SP-58 (1993) Pipe Hangers and Supports - Materials, Design and Manufacture

MSS SP-69 (1996) Pipe Hangers and Supports - Selection and Application

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54 (1999) National Fuel Gas Code

NFPA 70 (1999) National Electrical Code

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 6 (1994) Commercial Blast Cleaning

## UNDERWRITERS LABORATORIES (UL)

UL Gas&Oil Dir (1999) Gas and Oil Equipment Directory

## 1.2 GENERAL REQUIREMENTS

1.2.1 Not Used

1.2.2 Not Used

1.2.3 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Asbestos or products containing asbestos shall not be used. Manufacturer's descriptive data and installation instructions shall be submitted for approval for compression-type mechanical joints used in joining dissimilar materials and for insulating joints. Valves, flanges and fittings shall be marked in accordance with MSS SP-25.

1.2.4 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Gas Piping System;

Drawings showing location, size and all branches of pipeline; location of all required shutoff valves; and instructions necessary for the installation of connectors and supports.

## SD-03 Product Data

Qualifications; G-AO.

Qualified procedures and a list of names and identification symbols of qualified welders and welding operators.

## SD-06 Test Reports

Testing; G-AO.  
Pressure Tests; G-AO.

Test reports in booklet form tabulating test and measurements performed. The reports shall be dated after award of this contract, shall state the contractor's name and address, shall

name the project and location, and shall list the specific requirements which are being certified.

## PART 2 PRODUCTS

### 2.1 PIPE AND FITTINGS

#### 2.1.1 Steel Pipe, Joints, and Fittings

Steel pipe shall conform to ASME B36.10M. Malleable-iron threaded fittings shall conform to ASME B16.3. Steel pipe flanges and flanged fittings including bolts, nuts, and bolt pattern shall be in accordance with ASME B16.5. Wrought steel butt welding fittings shall conform to ASME B16.9. Socket welding and threaded forged steel fittings shall conform to ASME B16.11.

#### 2.1.2 Aluminum Alloy Pipe and Tubing, Joints, and Fittings

Aluminum alloy pipe shall conform to ASTM B 241/B 241M, except alloy 5456 shall not be used, and the ends of each length of pipe shall be marked indicating it conforms to NFPA 54. Pipe joints shall be threaded, flanged, brazed or welded.

Aluminum alloy tubing shall conform to ASTM B 210, Type A or B, or ASTM B 241/B 241M, Type A or equivalent. Tubing joints shall be made up with gas tubing fittings recommended by the tubing manufacturer.

#### 2.1.3 Copper Tubing, Joints and Fittings

Copper tubing shall conform to ASTM B 88, Type K or L, or ASTM B 280. Tubing joints shall be made up with tubing fittings recommended by the tubing manufacturer.

#### 2.1.4 Steel Tubing, Joints and Fittings

Steel tubing shall conform to ASTM A 539. Tubing joints shall be made up with gas tubing fittings recommended by the tubing manufacturer.

#### 2.1.5 Not Used

#### 2.1.6 Not Used

#### 2.1.7 Sealants for Steel Pipe Threaded Joints

Joint sealing compound shall be listed in UL Gas&Oil Dir, Class 20 or less. Tetrafluoroethylene tape shall conform to UL Gas&Oil Dir.

#### 2.1.8 Identification

Pipe flow markings and metal tags shall be provided as required.

#### 2.1.9 Flange Gaskets

Gaskets shall be nonasbestos compressed material in accordance with ASME B16.21, 1/16 inch thickness, full face or self-centering flat ring type. The gaskets shall contain aramid fibers bonded with styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR) suitable for a maximum 600 degree F service. NBR binder shall be used for hydrocarbon service.

### 2.1.10 Pipe Threads

Pipe threads shall conform to ASME B1.20.1.

### 2.1.11 Escutcheons

Escutcheons shall be chromium-plated steel or chromium-plated brass, either one piece or split pattern, held in place by internal spring tension or set screw.

### 2.1.12 Gas Transition Fittings

Gas transition fittings shall be manufactured steel fittings approved for jointing metallic and thermoplastic or fiberglass pipe. Approved transition fittings are those that conform to AGA Manual requirements for transition fittings.

### 2.1.13 Insulating Pipe Joints

#### 2.1.13.1 Insulating Joint Material

Insulating joint material shall be provided between flanged or threaded metallic pipe systems where shown to control galvanic or electrical action.

#### 2.1.13.2 Threaded Pipe Joints

Joints for threaded pipe shall be steel body nut type dielectric unions with insulating gaskets.

#### 2.1.13.3 Flanged Pipe Joints

Joints for flanged pipe shall consist of full face sandwich-type flange insulating gasket of the dielectric type, insulating sleeves for flange bolts, and insulating washers for flange nuts.

### 2.1.14 Flexible Connectors

Flexible connectors for connecting gas utilization equipment to building gas piping shall conform to ANSI Z21.45. Flexible connectors for movable food service equipment shall conform to ANSI Z21.69.

## 2.2 VALVES

Valves shall be suitable for shutoff or isolation service and shall conform to the following:

### 2.2.1 Valves 2 Inches and Smaller

Valves 2 inches and smaller shall conform to ASME B16.33 and shall be of materials and manufacture compatible with system materials used.

### 2.2.2 Valves 2-1/2 Inches and Larger

Valves 2-1/2 inches and larger shall be carbon steel conforming to API Spec 6D, Class 150.

## 2.3 PIPE HANGERS AND SUPPORTS

Pipe hangers and supports shall conform to MSS SP-58 and MSS SP-69.

## 2.4 METERS, REGULATORS AND SHUTOFF VALVES

Meters, regulators and shutoff valves shall be specified as follows:

### 2.4.1 METERS

Privately operated utility company shall provide meters and exterior regulators and service stops.

### 2.4.2 PRESSURE REGULATORS

Regulators shall have ferrous bodies, shall provide backflow and vacuum protection, and shall be designed to meet the pressure, load and other service conditions.

#### 2.4.2.1 Service Line Regulators

Pressure regulators for individual service lines shall have ferrous bodies.

Regulator shall be capable of reducing distribution line pressure to pressures required for users. Regulators shall be provided where gas will be distributed at pressures in excess of 10 inches of water column. Pressure relief shall be set at a lower pressure than would cause unsafe operation of any connected user. Regulator shall have single port with orifice diameter no greater than that recommended by the manufacturer for the maximum gas pressure at the regulator inlet. Regulator valve vent shall be of resilient materials designed to withstand flow conditions when pressed against the valve port. Regulator shall be capable of regulating downstream pressure within limits of accuracy and shall be capable of limiting the buildup of pressure under no-flow conditions to 50 percent or less of the discharge pressure maintained under flow conditions. Regulator shall have a self-contained service regulator. Regulator pipe connections shall not exceed 2-inch size.

### 2.4.3 SHUTOFF VALVES

Shutoff valves shall be in accordance with paragraph 2.2 VALVES.

## PART 3 EXECUTION

### 3.1 EXCAVATION AND BACKFILLING

Earthwork shall be as specified in Section 02316A EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

### 3.2 GAS PIPING SYSTEM

Gas piping system shall be from the point of delivery, defined as the outlet of the meter set assembly.

#### 3.2.1 Protection of Materials and Components

Pipe and tube openings shall be closed with caps or plugs during installation. Equipment shall be protected from dirt, water, and chemical or mechanical damage. At the completion of all work, the entire system shall be thoroughly cleaned.

#### 3.2.2 Workmanship and Defects

Piping, tubing and fittings shall be clear and free of cutting burrs and defects in structure or threading and shall be thoroughly brushed and chip-and scale-blown. Defects in piping, tubing or fittings shall not be repaired. When defective piping, tubing, or fittings are located in a system, the defective material shall be replaced.

### 3.3 PROTECTIVE COVERING

#### 3.3.1 Not Used.

#### 3.3.2 Aboveground Metallic Piping Systems

##### 3.3.2.1 Ferrous Surfaces

Shop primed surfaces shall be touched up with ferrous metal primer. Surfaces that have not been shop primed shall be solvent cleaned. Surfaces that contain loose rust, loose mill scale and other foreign substances shall be commercial sand blasted conforming to SSPC SP 6 and primed with ferrous metal primer. Primed surface shall be finished with two coats of exterior oil paint.

##### 3.3.2.2 Nonferrous Surfaces

Except for aluminum alloy pipe, nonferrous surfaces shall not be painted. Surfaces of aluminum alloy pipe and fittings shall be painted to protect against external corrosion where they contact masonry, plaster, insulation, or are subject to repeated wettings by such liquids as water, detergents or sewage. The surfaces shall be solvent-cleaned and treated with vinyl type wash coat. A first coat of aluminum paint and a second coat of alkyd gloss enamel or silicone alkyd copolymer enamel shall be applied.

### 3.4 INSTALLATION

Installation of the gas system shall be in conformance with the manufacturer's recommendations and applicable provisions of NFPA 54, AGA Manual, and as indicated. Pipe cutting shall be done without damage to the pipe. Unless otherwise authorized, cutting shall be done by an approved type of mechanical cutter. Wheel cutters shall be used where practicable. On steel pipe 6 inches and larger, an approved gas cutting and beveling machine may be used. Cutting of thermoplastic and fiberglass pipe shall be in accordance with AGA Manual.

#### 3.4.1 Metallic Piping Installation

Underground piping shall be buried a minimum of 18 inches below grade. Changes in direction of piping shall be made with fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either tees or forged branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Aluminum alloy pipe shall not be used in exterior locations or underground.

#### 3.4.2 Metallic Tubing Installation

Metallic tubing shall be installed using gas tubing fittings approved by the tubing manufacturer. Branch connections shall be made with tees. All tubing end preparation shall be made with tools designed for the purpose. Aluminum alloy tubing shall not be used in exterior locations or

underground.

### 3.4.3 Thermoplastic and Fiberglass Piping, Tubing, and Fittings

Thermoplastic and fiberglass piping, tubing, and fittings shall not be allowed aboveground and/or inside buildings.

### 3.4.4 Connections Between Metallic and Plastic Piping

Connections shall be made only outside, underground, and with approved transition fittings.

### 3.4.5 Piping Buried Under Buildings

Gas piping shall not be installed beneath buildings.

### 3.4.6 Concealed Piping in Buildings

When installing piping which is to be concealed, unions, tubing fittings, running threads, right- and left-hand couplings, bushings, and swing joints made by combinations of fittings shall not be used.

#### 3.4.6.1 Piping in Partitions

Concealed piping shall be located in hollow rather than solid partitions. Tubing passing through walls or partitions shall be protected against physical damage.

#### 3.4.6.2 Not Used

### 3.4.7 Aboveground Piping

Aboveground piping shall be run as straight as practicable along the alignment indicated and with a minimum of joints. Piping shall be separately supported. Exposed horizontal piping shall not be installed farther than 6 inches from nearest parallel wall in laundry areas where clothes hanging could be attempted.

### 3.4.8 Final Gas Connections

Unless otherwise specified, final connections shall be made with rigid metallic pipe and fittings. Final connections to kitchen ranges shall be made using flexible connectors not less than 40 in. long. In addition to cautions listed in instructions required by ANSI standards for flexible connectors, insure that flexible connectors do not pass through equipment cabinet. Provide accessible gas shutoff valve and coupling for each gas equipment item.

### 3.4.9 Connections to Publicly or Privately Operated Gas Utility Lines

Contractor shall provide materials for the connections to the existing gas lines. The utility company shall make final connections and the turning on of gas. The Contractor shall notify the Contracting Officer, in writing, 10 days before final connections and turning on of gas lines. The Contractor shall make necessary arrangements with the Utility for tie in and activation of new gas lines. Only the Operating Agency/Utility Company may reactivate the system after tie in. The Contractor shall furnish a certification by the Operating Agency/Utility Company that all Utility work has been satisfactorily completed.

### 3.5 PIPE JOINTS

Pipe joints shall be designed and installed to effectively sustain the longitudinal pull-out forces caused by contraction of the piping or superimposed loads.

#### 3.5.1 Threaded Metallic Joints

Threaded joints in metallic pipe shall have tapered threads evenly cut and shall be made with UL approved graphite joint sealing compound for gas service or tetrafluoroethylene tape applied to the male threads only. Threaded joints up to 1-1/2 inches in diameter may be made with approved tetrafluoroethylene tape. Threaded joints up to 2 inches in diameter may be made with approved joint sealing compound. After cutting and before threading, pipe shall be reamed and burrs shall be removed. Caulking of threaded joints to stop or prevent leaks shall not be permitted.

#### 3.5.2 Welded Metallic Joints

Beveling, alignment, heat treatment, and inspection of welds shall conform to ASME B31.2. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has been removed from its original package, it shall be protected or stored so that its characteristics or welding properties are not affected adversely. Electrodes that have been wetted or have lost any of their coating shall not be used.

#### 3.5.3 Not Used.

#### 3.5.4 Flared Metallic Tubing Joints

Flared joints in metallic tubing shall be made with special tools recommended by the tubing manufacturer. Flared joints shall be used only in systems constructed from nonferrous pipe and tubing, when experience or tests have demonstrated that the joint is suitable for the conditions, and when adequate provisions are made in the design to prevent separation of the joints. Metallic ball sleeve compression-type tubing fittings shall not be used for tubing joints.

#### 3.5.5 Solder or Brazed Joints

Joints in metallic tubing and fittings shall be made with materials and procedures recommended by the tubing supplier. Joints shall be brazed with material having a melting point above 1000 degrees F. Brazing alloys shall not contain phosphorous.

#### 3.5.6 Not Used.

### 3.6 PIPE SLEEVES

Pipes passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves shall not be installed in structural members except where indicated or approved. All rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective wall, floor or roof, and shall be cut flush with each surface, except in mechanical room floors not located on grade where clamping flanges or riser pipe clamps are used. Sleeves in mechanical room floors above grade shall

extend at least 4 inches above finish floor. Unless otherwise indicated, sleeves shall be large enough to provide a minimum clearance of 1/4 inch all around the pipe. Sleeves in bearing walls, waterproofing membrane floors, and wet areas shall be steel pipe. Sleeves in nonbearing walls, floors, or ceilings may be steel pipe, galvanized sheet metal with lock-type longitudinal seam, or moisture-resistant fiber or plastic. For penetrations of fire walls, fire partitions and floors which are not on grade, the annular space between the pipe and sleeve shall be sealed with firestopping material and sealant that meet the requirement of Section 07840A FIRESTOPPING.

### 3.7 PIPES PENETRATING WATERPROOFING MEMBRANES

Pipes penetrating waterproofing membranes shall be installed as specified in Section 15400A PLUMBING, GENERAL PURPOSE.

### 3.8 FIRE SEAL

Penetrations of fire rated partitions, walls and floors shall be in accordance with Section 07840A FIRESTOPPING.

### 3.9 ESCUTCHEONS

Escutcheons shall be provided for all finished surfaces where gas piping passes through floors, walls, or ceilings except in boiler, utility, or equipment rooms.

### 3.10 SPECIAL REQUIREMENTS

Drips, grading of the lines, freeze protection, and branch outlet locations shall be as shown and shall conform to the requirements of NFPA 54.

### 3.11 BUILDING STRUCTURE

Building structure shall not be weakened by the installation of any gas piping. Beams or joists shall not be cut or notched.

### 3.12 PIPING SYSTEM SUPPORTS

Gas piping systems in buildings shall be supported with pipe hooks, metal pipe straps, bands or hangers suitable for the size of piping or tubing. Gas piping system shall not be supported by other piping. Spacing of supports in gas piping and tubing installations shall conform to the requirements of NFPA 54. The selection and application of supports in gas piping and tubing installations shall conform to the requirements of MSS SP-69. In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for any of the individual pipes in the multiple pipe run. The clips or clamps shall be rigidly connected to the common base member. A clearance of 1/8 inch shall be provided between the pipe and clip or clamp for all piping which may be subjected to thermal expansion.

### 3.13 ELECTRICAL BONDING AND GROUNDING

The gas piping system within the building shall be electrically continuous and bonded to a grounding electrode as required by NFPA 70. Conventional flange joints allow sufficient current flow to satisfy this requirement.

### 3.14 METERS, REGULATORS AND SHUTOFF VALVES

Meters, exterior regulators and shut-off valves shall be installed by the gas utility company.

### 3.15 NOT USED.

### 3.16 TESTING

Before any section of a gas piping system is put into service, it shall be carefully tested to assure that it is gastight. Prior to testing, the system shall be blown out, cleaned and cleared of all foreign material. Each joint shall be tested by means of an approved gas detector, soap and water, or an equivalent nonflammable solution. Testing shall be completed before any work is covered, enclosed, or concealed. All testing of piping systems shall be done with due regard for the safety of employees and the public during the test. Bulkheads, anchorage and bracing suitably designed to resist test pressures shall be installed if necessary. Oxygen shall not be used as a testing medium.

#### 3.16.1 Pressure Tests

Before appliances are connected, piping systems shall be filled with air or an inert gas and shall withstand a minimum pressure of 3 pounds gauge for a period of not less than 10 minutes as specified in NFPA 54 without showing any drop in pressure. Oxygen shall not be used. Pressure shall be measured with a mercury manometer, slope gauge, or an equivalent device so calibrated as to be read in increments of not greater than 0.1 pound. The source of pressure shall be isolated before the pressure tests are made.

#### 3.16.2 Test With Gas

Before turning gas under pressure into any piping, all openings from which gas can escape shall be closed. Immediately after turning on the gas, the piping system shall be checked for leakage by using a laboratory-certified gas meter, an appliance orifice, a manometer, or equivalent device. All testing shall conform to the requirements of NFPA 54. If leakage is recorded, the gas supply shall be shut off, the leak shall be repaired, and the tests repeated until all leaks have been stopped.

#### 3.16.3 Purging

After testing is completed, and before connecting any appliances, all gas piping shall be fully purged. LPG piping tested using fuel gas with appliances connected does not require purging. Piping shall not be purged into the combustion chamber of an appliance. The open end of piping systems being purged shall not discharge into confined spaces or areas where there are ignition sources unless the safety precautions recommended in NFPA 54 are followed.

#### 3.16.4 Labor, Materials and Equipment

All labor, materials and equipment necessary for conducting the testing and purging shall be furnished by the Contractor.

### 3.17 PIPE COLOR CODE MARKING

Color code marking of piping shall be as specified in Section 09900

PAINTING, GENERAL.

-- End of Section --

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## SECTION 15200A

PIPELINES, LIQUID PROCESS PIPING  
03/02

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 105/A 105M	(2001) Carbon Steel Forgings for Piping Applications
ASTM A 126	(1995; R 2001) Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A 181/A 181M	(2001) Carbon Steel Forgings, for General-Purpose Piping
ASTM A 183	(1998) Carbon Steel Track Bolts and Nuts
ASTM A 193/A 193M	(2001a) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 194/A 194M	(2001) Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service or Both
ASTM A 307	(2000) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A 36/A 36M	(2000a) Carbon Structural Steel
ASTM A 47/A 47M	(1999) Ferritic Malleable Iron Castings
ASTM A 48	(1994a e1) Gray Iron Castings
ASTM A 53/A 53M	(2001) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 536	(1984; R 1999e1) Ductile Iron Castings
ASTM A 576	(1990b; R 1995e1) Steel Bars, Carbon, Hot-Wrought, Special Quality
ASTM A 780	(2000) Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings
ASTM A 858/A 858M	(2000) Heat-Treated Carbon and Steel Fittings for Low-Temperature and Corrosive

## Service

ASTM B 124/B 124M	(2000) Copper and Copper Alloy Forging Rod, Bar, and Shapes
ASTM D 1784	(1999a) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 1785	(1999) Poly(Vinyl Chloride)(PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2447	(1999) Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter
ASTM D 2464	(1999) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(1999) Poly(Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(1999) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2564	(1996a) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2609	(2000) Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe
ASTM D 2657	(1997) Heat Fusion Joining Polyolefin Pipe and Fittings
ASTM D 2683	(1998) Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
ASTM D 2855	(1996) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 3261	(1997) Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D 3350	(1999) Polyethylene Plastics Pipe and Fittings Materials
ASTM D 3892	(1993; R 1998) Packaging/Packing of Plastics
ASTM E 814	(2000) Fire Tests of Through-Penetration Fire Stops
ASTM F 1055	(1998) Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing

ASTM F 1056	(1997) Socket Fusion Tools for Use in Socket Fusion Joining Polyethylene Pipe or Tubing and Fittings
ASTM F 1290	(1998a) Electrofusion Joining Polyolefin Pipe and Fittings
ASTM F 402	(1993; R 1999) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings
ASTM F 477	(1999) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 656	(1996a) Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings

## AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA C104	(1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110	(1998) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other Liquids
AWWA C111	(2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C151	(1996) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
AWWA C504	(1994) Rubber-Seated Butterfly Valves
AWWA C508	(1993; C508a) Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS
AWWA C550	(1990) Protective Epoxy Interior Coatings for Valves and Hydrants

## ASME INTERNATIONAL (ASME)

ASME B1.20.1	(1983; R 1992) Pipe Threads, General Purpose (Inch)
ASME B16.1	(1998) Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.11	(1996) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.28	(1994) Wrought Steel Buttwelding Short Radius Elbows and Returns

ASME B16.5	(1996; B16.5a) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B31.3	(1999) Process Piping
DUCTILE IRON PIPE RESEARCH ASSOCIATION (DIPRA)	
DIPRA-Restraint Design	(1997) Thrust Restraint Design for Ductile Iron Pipe
MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)	
MSS SP-25	(1998) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(1996) Pipe Hangers and Supports - Selection and Application
MSS SP-89	(1998) Pipe Hangers and Supports - Fabrication and Installation Practices
NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)	
NEMA 250	(1997) Enclosures for Electrical Equipment (1000 Volts Maximum)
PLASTICS PIPE INSTITUTE (PPI)	
PPI AW-32 TR21	(2001) Thermal Expansion and Contraction of Plastic Pipe
THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)	
SSPC SP 6	(1994) Commercial Blast Cleaning
U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)	
29 CFR 1910	Occupational Safety and Health Standards

## 1.2 SYSTEM DESCRIPTION

This specification covers the requirements for above and below grade liquid process pipe, pipe supports, fittings, equipment and accessories located inside the hatchery building, beneath the hatchery building, as well as those lines servicing the raceways from the hatchery. All piping from the pump house to the rearing ponds, pump house to within five feet of the hatchery building, and drainage piping from the raceways, wastewater drains from the hatchery to the rearing ponds as well as all piping in and around the rearing ponds shall be as specified in Section 02531a SANITARY SEWERS and DRAINAGE PIPES and Section 02532a FORCEMAINS, INTAKE WATER

DISTRIBUTION. Polyethylene piping as it relates to this specification may be used only in buried applications beneath the hatchery building and in rearing trough/tank supply trenches; it shall not be used in the process area in above-grade applications. For specification information related to copper piping and for interior drain lines connected to the sanitary sewer, reference Section 15400A PLUMBING, GENERAL PURPOSE. Copper piping for process plumbing use shall conform to the requirements therein stipulated.

#### 1.2.1 Design Requirements

Support systems shall be selected and designed in accordance with MSS SP-58, MSS SP-69, and MSS SP-89 within the specified spans and component requirements. The absence of pipe supports and details on the contract drawings does not relieve the Contractor of responsibility for sizing and providing supports throughout facility.

#### 1.2.2 Performance Requirements

The pressure ratings and materials specified represent minimum acceptable standards for piping systems. The piping systems shall be suitable for the services specified and intended. Each piping system shall be coordinated to function as a unit. Flanges, valves, fittings and appurtenances shall have a pressure rating no less than that required for the system in which they are installed.

##### 1.2.2.1 Buried Piping Systems

Piping systems shall be suitable for design conditions, considering the piping both with and without internal pressure. Consideration shall be given to all operating and service conditions both internal and external to the piping systems. Buried ferrous piping shall have cathodic protection in accordance with Section 13110A CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE)

##### 1.2.2.2 Above Grade Piping Systems

Piping systems shall be suitable for design conditions, considering the piping both with and without internal pressure, and installation factors such as support spans, and ambient temperatures. Consideration shall be given to all operating and service conditions both internal and external to the piping systems.

#### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

##### SD-02 Shop Drawings

###### Pipe and Equipment; G-DO

Equipment shop drawings and support system detail drawings showing piping systems and appurtenances, such as mechanical joints, valves, local indicators and hangers, including a complete list of equipment and materials. As-built drawings showing pipe anchors and guides, and layout of piping systems relative to other

parts of the work including clearances for maintenance and operation. As-built piping and instrumentation diagrams (P&IDs) identifying and labeling equipment, instrumentation, valves, vents, drains, and all other inline devices; if the contract drawings contained P&IDs, the P&IDs found in the contract drawings shall be revised to reflect the constructed process system, as directed by the Contracting Officer.

#### SD-03 Product Data

##### Waste Water Disposal; G-AO

The method proposed for disposal of waste water from hydrostatic tests, and all required permits, prior to performing hydrostatic tests.

##### Delivery, Storage and Handling; G-AO

Material safety data sheets.

##### Materials and Equipment; G-AO

Manufacturer's descriptive and technical literature for each piping system, including design recommendations; pressure and temperature ratings; dimensions, type, grade and strength of pipe and fittings; thermal characteristics (coefficient of expansion and thermal conductivity); and chemical resistance to each chemical and chemical mixture in the liquid stream.

##### Installation; G-AO

The manufacturer's installation recommendations or instructions for each material or procedure to be utilized, including materials preparation.

##### Pipe Schedule; G-D0

A list of piping systems, pressure ratings and source of supply for each piping system broken out by material, size and application as indicated on the contract drawings. A list of any special tools necessary for each piping system and appurtenances furnished for adjustment, operation, maintenance and disassembly of the system.

##### Valve Schedule; G-D0

##### Operator Schedule; G-D0

A list of valve materials, pressure ratings, valve operator construction and materials, air supply pressure, electrical service, location, source of supply, and reference identification for all valves indicated in the contract drawings. A list of any special tools necessary for each valve type and appurtenances furnished for adjustment, operation, maintenance and disassembly.

#### SD-06 Test Reports

##### Pipe Leakage Tests; G-AO

##### Hydrostatic Tests; G-AO

##### Pneumatic Tests; G-AO

Valve Testing; G-AO  
Disinfection; G-AO

Copies of all field test reports within 24 hours of the completion of the test.

#### SD-10 Operation and Maintenance Data

Piping and Appurtenances; G-AO

Six copies each of operation and maintenance manuals in indexed booklet form. Operation manuals shall detail the step-by-step procedures required for specialized startup, operation and shutdown of piping systems, and shall include the manufacturer's name, model number, parts list and brief description of piping equipment such as valves and other appurtenances and their basic operating features. Maintenance manuals shall list routine maintenance procedures and troubleshooting guides for the equipment, and shall include piping layout and valve locations.

### 1.4 QUALIFICATIONS

#### 1.4.1 Contractor

Contractor shall have successfully completed at least 3 projects of the same scope and size or larger within the last 6 years. Contractor shall demonstrate specific experience in regard to the system installation to be performed.

#### 1.4.2 Welders

The welding of pressure piping systems shall be in accordance with qualifying procedures using performance qualified welders and operators. Procedures and welders shall be qualified in accordance with Section 05093A WELDING PRESSURE PIPING. Structural members shall be welded in accordance with AWS D1.1.

### 1.5 GENERAL JOB REQUIREMENTS

Piping materials and appurtenances shall be as specified and as shown on the drawings, and shall be suitable for the service intended. Piping materials, appurtenances and equipment supplied as part of this contract shall be new and unused except for testing equipment. Components that serve the same function and are the same size shall be identical products of the same manufacturer. The general materials to be used for the piping systems are indicated by service in the contract drawings. Above grade process piping within the hatchery process area shall be PVC, DI, or welded CS. Buried/below grade process piping within the process area may be PVC, HDPE or DI. Piping in the supply trenches to the rearing troughs and tanks shall be PVC or HDPE. Piping to the raceways shall be PVC, or DI. Heated/Treated water shall be conveyed in PVC piping above grade, and either PVC or HDPE for below grade.

#### 1.5.1 Components

Piping equipment and appurtenances shall be new products of equal material and ratings as the connecting pipe.

#### 1.5.2 Standard Products

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacturing of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Nominal sizes for standardized products shall be used. Pipe, valves, fittings and appurtenances shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

#### 1.5.3 Identification and Tagging

Each piece of pipe shall bear the ASTM designation and all other markings required for that designation. Valves shall be marked in accordance with MSS SP-25 and shall bear an identification tag securely attached using plastic straps designed for that purpose. Identification tags shall be 1.375 inch minimum diameter, made of engraved laminated plastic. Indentations shall be black for reading clarity. The service, valve identification number as shown on the Valve Schedule, the manufacturer's name, and the valve model number shall be displayed.

#### 1.6 DELIVERY, STORAGE AND HANDLING

Materials delivered and placed in storage shall be stored with protection from the weather, excessive humidity variation, excessive temperature variation, dirt, dust and/or other contaminants. Proper protection and care of material before, during and after installation is the Contractor's responsibility. Any material found to be damaged shall be replaced at the Contractor's expense. During installation, piping shall be capped to keep out dirt and other foreign matter. A material safety data sheet in conformance with 29 CFR 1910 Section 1200(g) shall accompany each chemical delivered for use in pipe installation. At a minimum, this includes all solvents, solvent cements, glues and other materials that may contain hazardous compounds. Handling shall be in accordance with ASTM F 402. Materials shall be stored with protection from puncture, dirt, grease, moisture, mechanical abrasions, excessive heat, ultraviolet (UV) radiation damage, or other damage. Pipe and fittings shall be handled and stored in accordance with the manufacturer's recommendation. Plastic pipe shall be packed, packaged and marked in accordance with ASTM D 3892.

#### 1.7 PROJECT/SITE CONDITIONS

##### 1.7.1 Environmental Requirements

Buried piping at the site may be subject to corrosion from the surrounding soil. Testing and measurements have been conducted in accordance with Section 13110A CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE). Piping system design, supply and installation shall address the external corrosion conditions so indicated.

##### 1.7.2 Existing Conditions

The Contractor shall be responsible for the verification of existing piping and penetrations. Prior to ordering materials, the Contractor shall expose all existing pipes which are to be connected to new pipelines. The Contractor shall verify the size, material, joint types, elevation, horizontal location, and pipe service of existing pipes, and inspect size and location of structure penetrations to verify adequacy of wall sleeves, and other openings before installing connecting pipes.

### 1.7.3 Verification of Dimensions

After becoming familiar with all details of the work, the Contractor shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

## 1.8 SEQUENCING AND SCHEDULING

For slab, floor, wall, and roof penetrations, the Contractor shall have on site pertinent wall pipes and sleeves before they are required for placement in concrete forms. The Contractor shall verify and coordinate the size and location of building and structure pipe penetrations before forming and placing concrete.

## 1.9 MAINTENANCE

### 1.9.1 Service

Services for automatic valve systems shall be provided by a manufacturer's representative who is experienced in the installation, adjustment and operation of the equipment specified. The representative shall inspect the installation, and supervise the adjustment and testing of the equipment.

### 1.9.2 Extra Materials

Concurrent with delivery and installation of the specified piping systems and appurtenances, spare parts for each different item of material and equipment specified that is recommended by the manufacturer to be replaced any time up to 3 years of service shall be furnished. For each type and size of valve, the following extra materials shall be provided: lubricator, lubricant (with appropriate temperature rating), lubricator/isolating valve. Extra materials shall include 2 of the following spare parts for each type and size of valve: gaskets; O-ring seals; diaphragms (molded); all elastomer parts; stem packing; seat rings and seat ring pulling tool.

## PART 2 PRODUCTS

### 2.1 MATERIALS (GENERAL)

Materials for various services shall be as specified above. Pipe fittings shall be compatible with the applicable pipe materials.

### 2.2 DUCTILE IRON PIPING SYSTEM

#### 2.2.1 Ductile Iron Pipe

Ductile iron pipe for pressure service shall have a design and wall thickness conforming to AWWA C151. Ductile iron pipe shall have a standard cement lining conforming to AWWA C104.

#### 2.2.2 Ductile Iron Joints

Joints shall have a working pressure rating for liquids equal to the pressure rating of the connected pipe. Dielectric fittings or isolation joints shall be provided between all dissimilar metals.

##### 2.2.2.1 Mechanical Joints

Mechanical joints shall conform to AWWA C110 and AWWA C111. Gaskets,

glands, bolts and nuts shall be furnished in sufficient quantity for the complete assembly of each mechanical joint. Glands shall be ductile or gray iron with an asphaltic coating. Gaskets shall be vulcanized synthetic rubber, reclaimed rubber is not acceptable. For grooved shoulder piping, self-centering gasketed couplings designed to mechanically engage piping and lock in a positive watertight couple shall be used. Housings shall be composed of malleable iron, ASTM A 47/A 47M or ductile iron, ASTM A 536 and gaskets of molded synthetic rubber shall be used. Bolts and nuts shall be heat treated carbon steel, ASTM A 183, minimum tensile 110,000 psi. Mechanical joints shall have bolt holes oriented straddling the vertical centerline of the valves and fittings.

#### 2.2.2.2 Push-on Joints

Each push-on joint shall be supplied complete with gasket and lubricant. Gaskets shall be compatible with joint design and comprised of vulcanized synthetic rubber, reclaimed rubber is not acceptable. Lubricant shall be specifically formulated for use with push-on joints and shall be non-toxic, odorless, tasteless and shall not support bacteria growth.

#### 2.2.2.3 Restrained Joints

Restrained joints shall be designed for a working pressure equal to connected pipe rating. When using ductile iron pipe with restrained joints, field cuts shall be supplied with a lock ring complete with retainer, retainer lock and roll-pin, as required by manufacturer's recommendations, procedures and/or installation instructions.

#### 2.2.2.4 Flanged Joints

Flanged joints shall conform to AWWA C110. Gaskets, bolts and nuts shall be provided with flanged joints in sufficient quantity for the complete assembly of each joint. Gaskets shall be vulcanized synthetic rubber, reclaimed rubber is not acceptable.

#### 2.2.3 Ductile Iron Fittings

Fittings shall be gray iron ASTM A 48 or ductile iron AWWA C110. Up to 24 inches inclusive, the fittings shall be 150 psig rated. Gray iron fittings shall be cement mortar lined standard thickness. Flanges and flanged fittings shall conform to AWWA C110 or ASME B16.1 and shall be rated for 150 psig service. Materials shall be ductile iron or gray iron. For tie-in to existing flanges, the Contractor shall field check existing flanges for nonstandard bolt hole configurations and shall design as required to assure new pipe and flange mate properly. Bolts and nuts shall be carbon steel conforming to ASTM A 307, Grade B. Bolts shall be provided with washers of the same material as the bolts. Gaskets shall be full face, maximum 0.125 in thick.

#### 2.2.4 Corrosion Control

Ductile iron piping shall be coated with the manufacturer's standard asphaltic coating, approximately 1 mil thick, applied to the outside of pipe and fittings. Buried pipe shall be coated and wrapped, and provided with cathodic protection in accordance with Section 13110A CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE).

### 2.3 CARBON STEEL PIPING SYSTEM

### 2.3.1 Carbon Steel Pipe

#### 2.3.1.1 General Service

Carbon steel pipe shall meet the requirements of ASTM A 53/A 53M seamless butt welded, Grade B, Schedule 20 or standard weight class and shall be painted in accordance with specification Section 09900 PAINTS AND COATINGS.

#### 2.3.2 Carbon Steel Joints

Carbon steel piping shall be joined by welding fittings. Dielectric fittings or isolation joints shall be provided between all dissimilar metals.

#### 2.3.3 Carbon Steel Fittings

Fittings shall be carbon steel. Where cast fittings are not available, segmental welded steel fittings, ASTM A 53/A 53M, Grade B, meeting the requirements of manufacturer's recommended wall thicknesses shall be fabricated.

##### 2.3.3.1 Welding Fittings

Welding fittings shall be by butt-welding. Welding fittings shall be forged steel, ASTM A 105/A 105M Class 150, low-carbon steel, ASTM A 858/A 858M seamless or welded conforming to ASME B16.9, ASME B16.28, or ASME B16.11.

#### 2.3.4 Carbon Steel Coatings

Carbon steel piping components shall be coated with corrosion resistant materials. Coatings and finishes shall be 100 percent holiday free.

#### 2.3.5 Carbon Steel Cathodic Protection

Buried ferrous piping shall have cathodic protection.

### 2.4 POLYVINYL CHLORIDE (PVC)

#### 2.4.1 PVC Pipe

PVC pipe shall be Schedule 40 for all process piping greater than four inches in diameter, and schedule 80 for all threaded piping four inches in diameter and below. Piping shall conform to ASTM D 1785.

#### 2.4.2 PVC Tubing

Tubing shall be flexible and clear with nominal size and wall thickness in accordance with the drawings.

#### 2.4.3 PVC Joints

The piping system shall be joined by socket-weld, flanged or mechanical connections except where connecting to unions, valves, and equipment with threaded connections that may require future disassembly. Connections at those points shall be threaded and back-welded. Tubing connections shall use compression fittings.

#### 2.4.4 PVC Fittings

The schedule rating for the fittings shall not be less than that for the associated pipe. Fittings shall be ASTM D 1784 PVC conforming to the requirements of ASTM D 2464, threaded in accordance with ASME B1.20.1, ASTM D 2466, socket type or ASTM D 2467, socket type.

##### 2.4.4.1 Push-on Joints

Push-on type joints shall be sealed with ethylene propylene rubber (EPR) gaskets in accordance with ASTM F 477.

##### 2.4.4.2 Flanged Fittings

Flanges and flanged fittings shall be Class 125, one piece, molded hub type, flat faced, and shall conform to ASME B16.1 or ASME B16.5 backing flanges with appropriate drilling. Flanged connections shall have the same pressure rating as the pipe or greater. Bolting shall be stainless steel, ASTM A 193/A 193M, Grade B8 hex head bolts and ASTM A 194/A 194M, Grade 8 hex head nuts. Bolts shall be provided with washers of the same material as the bolts. Gaskets shall be full-faced, maximum 1/8 inch thick, fabricated from ethylene propylene rubber (EPR) in accordance with ASME B16.21. When the mating flange has a raised face, a flat ring gasket shall be used and a filler gasket shall be provided between outer diameter of the raised face and the flange outer diameter to protect the PVC flange from bolting moment.

##### 2.4.4.3 Tubing Fittings

Fittings shall be compression type comprised of forged brass alloy C37700, conforming to ASTM B 124/B 124M, nuts, ferrules and bodies.

##### 2.4.5 PVC Solvent Cement

Socket connections shall be joined with PVC solvent cement conforming to ASTM D 2564. Manufacture and viscosity shall be as recommended by the pipe and fitting manufacturer to assure compatibility. Joints shall be prepared with primers conforming to ASTM F 656 prior to cementing and assembly.

#### 2.5 POLYETHYLENE (PE)

##### 2.5.1 PE Pipe

The pipe shall be extruded from PE, ASTM D 3350. The PE pipe shall be Schedule 40 conforming to ASTM D 2447, so that the pressure rating of the pipe shall be consistent for all pipe sizes, or the pipe shall be SDR 17 with a pressure rating of 100 psig at 73 degrees F.

##### 2.5.2 PE Tubing

Tubing shall be flexible and dimensioned in accordance with the drawings.

##### 2.5.3 PE Joints

PE pipe shall be joined by thermal butt-fusion, socket heat fusion, and/or socket electrofusion, except where connecting to valves and equipment that may require future disassembly, then joints shall be threaded or flanged.

##### 2.5.4 PE Fittings

PE fittings shall have the same or higher pressure rating as the pipe when installed in accordance with the latest technical specifications. PE fittings shall be molded. Butt-fusion fittings shall conform to ASTM D 3261.

Socket-fusion fittings shall conform to ASTM D 2683 with tools meeting the requirements of ASTM F 1056. Insert fittings shall conform to ASTM D 2609.

#### 2.5.4.1 Couplings

Couplings and saddle joints shall be joined by electrofusion in accordance with ASTM F 1055.

#### 2.5.4.2 Flanged Fittings

Flanges and flanged fittings shall be Class 125, backing flanges with appropriate drilling. Flanges shall be complete with one-piece, molded PE stub ends. Flanged connections shall have the same pressure rating as the pipe or greater. Bolting shall be stainless steel, ASTM A 193/A 193M, Grade B8 hex head bolts and ASTM A 194/A 194M, Grade 8 hex head nuts. Bolts shall be provided with washers of the same material as the bolts. Gaskets shall be full-faced, maximum 1/8 inch thick, fabricated from ethylene propylene rubber (EPR) in accordance with ASME B16.21.

#### 2.5.4.3 Tubing Fittings

Fittings shall be compression type comprised of forged brass alloy C37700, conforming to ASTM B 124/B 124M, nuts, ferrules and bodies.

### 2.6 ISOLATION JOINTS AND COUPLINGS

#### 2.6.1 Dielectric Fittings

Dielectric fittings shall be provided between threaded ferrous and nonferrous metallic pipe, fittings and valves. Dielectric fittings shall prevent metal-to-metal contact of dissimilar metallic piping elements and shall be suitable for the required working pressure, temperature and corrosive application.

#### 2.6.2 Isolation Joints

Isolation joints shall be provided between nonthreaded ferrous and nonferrous metallic pipe fittings and valves. Isolation joints shall consist of an isolation gasket of the dielectric type, isolation washers and isolation sleeves for flange bolts. Isolation gaskets shall be full faced with an outside diameter equal to the flange outside diameter. Bolt isolation sleeves shall be full length. Units shall be of a shape to prevent metal-to-metal contact of dissimilar metallic piping elements.

#### 2.6.3 Metallic Piping Couplings

Thrust ties shall be provided where required to restrain the force developed by 1.5 times the maximum allowable operating pressures specified.

For metallic pipe other than ductile iron, thrust ties shall be attached with fabricated lugs. For ductile iron pipe, thrust ties shall be attached with socket clamps against a grooved joint coupling or flange. For exposed installations, zinc-plated nuts and bolts shall be used. However, high-strength, low-alloy steel, in accordance with AWWA C111, may be substituted for use on cast iron and ductile iron couplings. For buried and submerged installations, TP304 stainless steel bolts and nuts shall be

provided. Steel middle rings and followers shall be fusion bonded epoxy-lined and coated.

#### 2.6.3.1 Sleeve-Type Couplings

Sleeve-type couplings shall be used for joining plain end pipe sections in a flexible manner with a diameter to properly fit the pipe. A coupling shall consist of one steel or ductile iron middle ring, two steel or ductile iron followers, two elastomeric section gaskets and elliptic-neck, track-head steel bolts designed to properly compress the gaskets. Gaskets shall be as recommended by the manufacturer.

#### 2.6.3.2 Transition Couplings

Transitional couplings may be used to connect two pipes of the same material that have small differences in outside diameter. A fully assembled transitional coupling shall be sized to properly fit pipe diameters. The coupling shall consist of one steel or ductile iron middle ring, two steel or ductile iron followers, two elastomeric section gaskets and elliptic-neck, track-head steel bolts designed to properly compress the gaskets. The coupling shall use manufacturer's recommended gaskets. The coupling shall be sized to match the associated piping.

#### 2.6.3.3 Flanged Coupling Adapters

Flanged coupling adapters shall be fully assembled units manufactured to meet ASTM A 126 Class B, cast iron. The flanges shall mate with flanges of the same nominal size. The coupling shall use manufacturer's recommended gaskets. Where pipe movement out of the adaptor may occur, proper anchorage of the pipe shall be provided. The coupling shall be sized to match the associated piping.

#### 2.6.4 Couplings for Nonmetallic Piping

##### 2.6.4.1 Bellows Coupling

A bellows coupling shall have a flanged face drilled to Class 125 end connections, and metal reinforcing bands. The maximum allowable working pressure shall be 100 psig at 73 degrees F. Bolting shall be limited to restrain the force developed by 1.5 times the specified maximum allowable operating pressure. The coupling shall be sized to match the associated piping.

##### 2.6.4.2 Compression Coupling

A compression coupling shall consist of one steel middle section, two steel mechanical nuts, two elastomeric gaskets and two machined steel lock rings. The coupling shall use manufacturer's recommended gaskets. The maximum allowable working pressure shall be 100 psig at 73 degrees F. The coupling shall be sized to match the associated piping.

#### 2.7 VALVE BOXES, VALVE MANHOLES AND VALVE PITS

The box length shall adapt to the length required for the depth of the line without full extension. Boxes shall be cast iron or concrete, except that concrete boxes may be installed only in locations not subjected to vehicular traffic. The boxes shall have housings of sufficient size to completely cover the valve or service stop and shall be complete with covers.

### 2.7.1 Valve Boxes

Cast-iron valve boxes shall have minimum metal thickness of 3/16 inch and boxes shall be extension type with slide-type adjustment and with flared base. Concrete boxes shall be the standard product of a manufacturer of precast concrete equipment.

#### 2.7.1.1 Service Boxes

Service boxes shall be extension service boxes with either screw or slide-type adjustment.

## 2.8 VALVES

### 2.8.1 General Requirements For Valves

Valves shall include operator, actuator, handwheel, chain wheel, extension stem, operating nut, chain, and all other accessories required for a complete operation. The valves shall be suitable for the intended service.

Renewable parts are not to be of a lower quality than those specified. Valve ends shall be compatible with adjacent piping system. An operator shall be sized to operate the associated valve for the full range of pressures and velocities. Valves will open by turning counterclockwise. Operators, actuators, and accessories shall be factory mounted.

### 2.8.2 Valve Schedule

Contractor shall provide valve schedule to include a list of valve materials, pressure ratings, valve operator type and materials, air supply pressure, electrical service, location, source of supply, and reference identification as indicated in the contract drawings. A list of any special tools necessary for each valve type and appurtenances furnished for adjustment, operation, maintenance and disassembly shall also be included.

### 2.8.3 Factory Finishing

Valves shall have an epoxy coating in accordance with AWWA C550 unless otherwise specified. The epoxy shall be either a two-part liquid material or a heat-activated (fusion) material except that only a heat-activated material shall apply if a valve coating is specified as "fusion" or "fusion bonded" epoxy. The epoxy coating shall have a minimum 7.0 mils dry film thickness except where it is limited by valve operating tolerances. Exposed valves shall be finished in accordance with Section 09900 PAINTS AND COATINGS.

### 2.8.4 Check Valves

#### 2.8.4.1 Swing Check Valves

Swing check valves shall conform to the following:

- a. Swing check valves, 2 inches through 36 inches, shall conform to AWWA C508, and have flanged, welded, mechanical joint or grooved end connections. Valves shall have a cast iron, ductile iron, carbon steel body, bronze-mounted disc, solid bronze or ductile iron hinges, and a stainless steel hinge shaft. Valves 2 inches through 36 inches shall be rated for 150 psig service. Valves shall be fitted with an adjustable outside lever and spring or

weight. An increasing-pattern body valve may be used where increased outlet piping size is shown.

## 2.8.5 Ball Valves

### 2.8.5.1 General Purpose Ball Valves

General purpose ball valves shall conform to the following:

- a. Ball valves, 2 inches and smaller, shall be end entry type with bronze or brass bodies and threaded, in accordance with ASME B1.20.1, regular ports. Valves shall have polytetrafluoroethylene (PTFE) seats and packing, brass or stainless steel balls and hand lever or tee-handle operators. Valves shall be rated for 400 psig service. A union shall be installed adjacent to the valves to provide access to the seat.
- b. Ball valves, 2.5 inches and larger, shall be end entry type with bronze or cast iron bodies and ASME B16.11 socket-welding, ASME B16.11 threaded, ASME B16.5 flanged or ASME B16.1 flanged ends. Valves shall have polytetrafluoroethylene (PTFE) packing and seats, a brass or stainless steel ball, regular ports, and hand lever or tee-handle operators. Valves shall be rated for 400 psig service.

### 2.8.5.2 Thermoplastic Ball Valve

Thermoplastic ball valves, 6 inches and smaller, shall be rated for 225 psig service, polyvinyl chloride (PVC) bodies, balls, and stems. Valves shall be end entry, double union design, with solvent-weld socket, threaded in accordance with ASME B1.20.1, flanged, or butt ends connections, with manufacturer's recommended seat and O-ring stem seals. Valves shall have hand lever operators.

## 2.8.6 Gate Valves

### 2.8.6.1 General Service Gate Valves

General service gate valves shall conform to the following:

- a. Gate valves, 2 inches and smaller, shall have bronze bodies and stems, screwed, union, bolted or yoke bronze bonnets, single wedge bronze discs, and non-rising stems. Valves shall be rated for 175 psig service. End connections shall be ASME B16.5 flanged, ASME B16.1 flanged, or ASME B16.11 threaded. Valves shall be equipped with handwheel operators.
- b. Gate valves, 2.5 inches and larger, shall have cast-iron bodies with iron or bronze trim. Valves shall have Class 125 flanged, welding, threaded, mechanical joint or push-on end connections. Bonnet shall be a clamp, OS&Y Bolted, or NRS Bolted type. Discs shall be of iron, bronze, or ductile iron construction, and have nonrising stems. Valves shall be rated for 200 psig service. Valves shall be equipped with handwheel operators.

### 2.8.6.2 Thermoplastic Gate Valve

Thermoplastic gate valves, 0.5 inches and larger, shall have ASTM D 1784 polyvinyl chloride (PVC) bodies, bolted bonnets, single wedge discs,

non-rising stems, and flanged or threaded end connections. Valves shall be rated for 150 psig service. Valves shall be equipped with handwheel operators.

#### 2.8.7 Plug Valves

##### 2.8.7.1 Eccentric Valve

Nonlubricated type eccentric valves, 3 inches and smaller, shall be rated for 175 psig service. Valves shall have drip-tight shutoff with pressure from either direction, and cast iron, bronze, carbon steel, or stainless steel bodies, in accordance with flanged, threaded, grooved end connections, plugs with round or rectangular ports, stainless steel or nickel seats, self-lubricating stainless steel, Monel, or nickel stem bearings, and manufacturer's recommended seals. Valves shall be equipped with handwheel operators.

#### 2.8.8 Butterfly Valves

##### 2.8.8.1 Standard Service Butterfly Valve

Butterfly valves, 2 inches and larger, shall have ASTM A 126 cast iron or ductile iron bodies, lugged styled with flanged or mechanical joint end connections. Valves shall as a minimum conform to AWWA C504 Class 125. Discs shall be aluminum bronze ASTM B 148 C95200 Grade A. The valve shafts shall be stainless steel with self-lubricating, corrosion-resistant sleeve type bearings. Valve seats for 24 inch and smaller valves shall be attached to either the valve body or the disc and shall be constructed of ethylene propylene diene monomer (EPDM). Valves shall have manual, locking hand lever, chain wheel, and/or pneumatically actuated/electrically actuated operators as defined in the drawings. The two - ten inch actuated valves located downstream of the raw water storage tanks, prior to the disc filtration unit shall be pneumatically actuated, with an electrical positioner. See paragraph "Pneumatic Operator" in this specification.

##### 2.8.8.2 Thermoplastic Butterfly Valves

Thermoplastic butterfly valves, 1.5 inch and larger, shall have wafer or lugged style bodies, unless otherwise specified, constructed of polyvinyl chloride (PVC) or polypropylene (PP). Valves shall have polyvinyl chloride (PVC) or polypropylene (PP) discs, ethylene propylene diene monomer (EPDM) seats, same material as seats seals, and lever operators. Valves shall be rated for 150 psig

#### 2.8.9 Operators

##### 2.8.9.1 Operator Schedule

Requirements relative to this paragraph are indicated in paragraph VALVE SCHEDULE.

##### 2.8.9.2 Manual Operator

The force in a manual operator shall not exceed 39.3 pound under any operating condition, including initial breakaway. The operator shall be equipped with gear reduction when force exceeds 39.3 pound. The manual operator shall be a self-locking type or shall be equipped with a self-locking device. A position indicator shall be supplied on quarter-turn valves.

- a. Exposed Operators. Exposed operators shall have galvanized and painted handwheels. Lever operators are allowed on quarter-turn valves 8 inches and smaller. Cranks shall be supplied on gear type operators. If located off of the operator floor, chain wheel operator with tiebacks, extension stem, floor stands, and other accessories shall be provided to permit operation from normal operation level. Valve handles shall be capable of padlocking, and wheels shall be lockable with a chain and padlock.
- b. Underground Operators. Buried service operators on valves larger than 2.5 inches shall have a 2 inch operating nut. Buried operators on valves 2 inches and smaller shall have a cross handle for operation by a forked key. The moving parts of valve and operator shall be enclosed in housing to prevent contact with the soil. Buried service operators for quarter-turn valves shall be designed to withstand an input torque of 450 foot-pound of input torque at the fully open or fully closed positions, and shall be grease packed and gasketed to withstand a submersion in water to 10.2 psig. Buried valves shall have extension stems, bonnets, and valve boxes. Valve boxes at raceway risers shall extend approximately 8" above grade.

#### 2.8.9.3 Pneumatic Operator

Pneumatic operators for the two - ten inch butterfly valves located downstream of the raw water storage tanks shall be provided complete with actuators, air sets, exhaust mufflers, speed controls, pilot solenoids, safety vented isolation valves, and accessories. Valve assembly shall be Keystone 10" lug body butterfly valve, with a Tyco/Morin Spring return pneumatic actuator, Tyco/Avid 4-20 mA Positioner, and an ASCO 3-way solenoid valve or Engineer approved equal. The pneumatic operators shall be suitable for full operation range of valve at air supply pressure indicated. Actuators shall return the valve to the closed position upon loss of signal unless otherwise indicated. Springs shall return the valve to this failed position. Limit switches shall be provided on all actuators.

- a. Cylinder Actuators. Cylinder actuators shall operate with an air supply pressure of 80 psig. The nonswivel type shall be totally enclosed with travel stops and position indicator, and shall be factory lubricated and sealed, requiring no additional lubrication. The double acting type shall be nonmetallic for operation on nonlubricated air and shall have a manual override independent of the cylinder.
- e. Positioners. The positioners for modulating actuators shall be pneumatic force balance instruments to control valve positions as a function of the input signals. The positioners shall accomplish positive positioning of valve by a mechanical feedback connection from the valve actuating mechanism. Position feedback shall be provided through a characterized linear cam to allow adjustment of valve positioning and input signal. The positioner shall be suitable for either a double acting or spring return actuator. The positioner shall have zero and span adjustment and be field reversible for direct or reverse action. Gauges shall be included for supply and output pressure and for input signal pressure. Modulating valve positioners shall operate on a 4 to 20 mA electric input signal unless otherwise indicated. If separate, the transducer shall be factory mounted on the pneumatic operator.

Corrosion-resistant enclosures for positioners and transducers shall be splash- and moisture-proof with gasketed covers.

- f. Solenoid Valve. A solenoid valve shall pilot the control actuator in the appropriate configuration for the type of actuator being controlled. Internal parts shall be corrosion-resistant. Solenoids on spring return cylinders for open-close and throttling valves shall be three-way, spring return. An air exhaust muffler shall be furnished in the exhaust port of all actuator pilot solenoid valves.

#### 2.8.10 Valve Accessories

##### 2.8.10.1 Extension Bonnet for Valve Operator

All extension bonnets shall be provided as necessary, complete with stem and accessories applicable to the specific valve and operator.

##### 2.8.10.2 Chain Wheel and Guide

A chain wheel and guide shall be the handwheel direct-mount type, complete with galvanized or cadmium-plated chain.

#### 2.9 MISCELLANEOUS PIPING COMPONENTS

##### 2.9.1 Indicating Devices

###### 2.9.1.1 Pressure and Vacuum Gauges

Pressure and vacuum gauges shall be stem mounted, with phenolic or aluminum cases and dry or glycerine-filled dials and snubbers as required to provide dampening. The gauges shall be equipped with threaded 0.25 inch male or female connections. The dials of the gauges shall be 4.5 inches in diameter with scale readings in psig ranging from zero to approximately twice the anticipated process operating or equipment pressure.

###### 2.9.1.2 Thermometers

Thermometers shall be bi-metal actuated, with 5 inches dished anti-parallax dials that have external calibration adjustment and stainless steel cases. The union connections with associated thermowells shall be included. Scale shall be 25 to 125 degrees F with accuracy within one scale division.

###### 2.9.1.3 Thermowells

Thermowells shall be TP316 stainless steel with a diameter of 1 inch. The length shall be as shown on the contract drawings and coordinated with the associated temperature element. Process connections shall be constructed of stainless steel. Thermowells that shall be used with thermocouples or RTDs shall be equipped with terminal connection heads rated NEMA 250 Type 4X.

##### 2.9.2 Expansion Joints

The Contractor shall provide all structural work and equipment required to control expansion and contraction of piping. The Contractor shall verify that the anchors, guides, and expansion joints provided, adequately protect the piping systems.

### 2.9.2.1 Expansion Joint for Metallic Pipe

The expansion joint shall be as recommended by the piping manufacturer. The expansion joint shall be sized to match the associated piping. The maximum allowable working pressure shall be 150 psig. End connections shall be as specified for the associated pipe joints.

### 2.9.2.2 Expansion Joint for Nonmetallic Piping

A bellows expansion joint shall be used. The maximum allowable working pressure shall be 100 psig. Bolting shall be limited to restrain the force developed by 1.5 times the specified maximum allowable operating pressure. The expansion joint shall be sized to match the associated piping.

## 2.10 PIPE SUPPORTS AND PENETRATIONS

Auxiliary steel shall be provided by the Contractor where the support of piping systems and equipment is required between building structural elements. Supports shall be designed to restrain longitudinal movement where indicated and as otherwise appropriate to prevent significant displacement under varying flow conditions. Light gauge and structural steel shapes shall conform to the requirements of ASTM A 36/A 36M.

### 2.10.1 Pipe Supports

Pipe supports shall conform to the requirements of MSS SP-58, MSS SP-69, and MSS SP-89. Where pipe supports contact bare piping or in-line devices, provide supports of compatible material so that neither shall have a deteriorating action on the other. Supports shall also be provided for the filter overflow trough and its associated piping.

#### 2.10.1.1 Beam Clamps

For upper attachments on structural steel, the Contractor shall provide beam clamps of ASTM A 36/A 36M carbon steel or ASTM A 181/A 181M forged steel and MSS SP-58 Types 19 through 23, 25 or 27 through 30. Holes drilled in structural steel for hanger support rods will not be permitted. Clamps shall be provided with hardened steel cup-point set screws and lock-nuts for anchoring in place. Clamp size selection shall only be based on the support of the required load.

#### 2.10.1.2 Riser Clamps

Vertical runs of piping shall be supported at each floor, or closer where required, with ASTM A 36/A 36M carbon steel clamps bolted around pipes and attached to the building construction.

#### 2.10.1.3 Brackets

Where piping is run adjacent to walls or steel columns, the Contractor shall provide welded ASTM A 36/A 36M steel brackets, pre-punched with a minimum of two fastener holes.

#### 2.10.1.4 Offset Pipe Clamp

Where pipes are indicated as offset from wall surfaces, a double-leg design two-piece pipe clamp shall be supplied by the Contractor.

#### 2.10.1.5 Racks

Multiple pipe racks or trapeze hangers shall be fabricated from ASTM A 36/A 36M steel, and designed to suit the conditions at the points of installation. Pipes shall be kept in their relative positions to each other by the use of clamps or clips. Pipelines subject to thermal expansion must be free to slide or roll.

#### 2.10.1.6 Hangers

Hangers shall be fabricated of malleable iron, ASTM A 47/A 47M or ASTM A 36/A 36M carbon steel. All hangers shall be of a uniform type and material for a given pipe run and application. Coated or plated hangers shall be used to isolate steel hangers from dissimilar metal tube or pipe. Hangers for pipe sizes 2.5 inches or larger shall incorporate a means of vertical adjustment after erection while supporting the load. Hangers shall be spaced as required to prevent excessive loading of the structure, or Contractor shall provide supplemental support structure as directed and approved.

#### 2.10.1.7 Hanger Rods

Hanger rods shall be carbon steel conforming to ASTM A 576.

#### 2.10.2 Pipe Guides

##### 2.10.2.1 Intermediate Guides

For piping 6 inch and smaller, a pipe clamp with an oversize pipe sleeve shall be provided for a minimum 0.16 inch clearance. For piping 8 inch and larger, U-bolts with double nuts that are manufactured for the purpose shall be used to provide a minimum 0.28 inch clearance around pipe. The stock sizes for the U-bolts are as follows: for a 8 inch pipe use a 0.625 inch U-bolt; for a 10 inch pipe, use a 0.75 inch U-bolt; for a 12 inch to 16 inch pipe, use a 0.875 inch U-bolt; and for 18 inch to 30 inch pipes use 1 inch U-bolts.

##### 2.10.2.2 Alignment Guides

For piping, 8 inch and smaller, alignment guides shall be galvanized steel, spider or sleeve type. For piping, 10 inch and larger, alignment guides shall be galvanized steel, roller type guides.

#### 2.10.3 Flashing Sleeves

Galvanized steel flashing sleeves shall be installed wherever piping passes through concrete roof structures. Where piping penetrates roofs, 4 lb. flashing shall be provided. The flashing shall extend 8 inches from the pipe in all directions, extend up the pipe, and shall be fitted with double-threaded flashing for pipes 3 inches and smaller. Flashing shall turn down inside the pipe for 4 inches and larger pipes.

#### 2.10.4 Wall Penetrations

##### 2.10.4.1 Above Grade Wall Penetrations

Piping which passes through fire-rated or smoke-rated walls, floors, or ceilings shall be provided with insulated and encased pipe sleeves. Penetrations through an existing fire or fire barrier wall shall be sealed with a fire stop system that has an "F" rating not less than the required

fire resistance rating of the penetrated wall. The fire stopping sealant for metal piping systems shall be rated for 3 hours pursuant to ASTM E 814 and UL requirements. The fire stopping sealant for plastic and insulated piping systems shall be rated for 3 hours pursuant to ASTM E 814 and UL requirements with metal collars. Vented plastic pipe penetrations shall be fitted with galvanized steel collars that have intumescent inlays.

#### 2.10.4.2 Below Grade Wall Penetrations

Below-grade wall penetrations shall be provided with hydrostatic seals designed to seal opening between pipe or conduit and a through-structure opening. The seals shall be modular mechanical type consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening.

### 2.11 MISCELLANEOUS MATERIALS

## PART 3 EXECUTION

### 3.1 PREPARATION

#### 3.1.1 Protection

Pipe and equipment openings shall be closed with caps or plugs during installation. Equipment shall be protected from dirt, water, and chemical or mechanical damage.

#### 3.1.2 System Preparation

##### 3.1.2.1 Pipe and Fittings

Pipe and fittings shall be inspected before exposed piping is installed or buried piping is lowered into the trench. The Contractor shall clean the ends of pipes thoroughly, remove foreign matter and dirt from inside of pipes, and keep piping clean during and after laying.

##### 3.1.2.2 Damaged Coatings

The Contractor shall repair damaged coating areas in the field with material equal to the original coating, except for damaged glass-lined pipe which shall be promptly removed from the site. The Contractor shall not install damaged piping materials. Field repair of damaged and uncoated areas of galvanized piping shall conform to ASTM A 780.

##### 3.1.2.3 Field Fabrication

The Contractor shall notify the Contracting Officer at least 2 weeks prior to the field fabrication of pipe or fittings and at least 3 days prior to the start of any surface preparation or coating application work. Field welding shall be performed in accordance with Section 05093A WELDING PRESSURE PIPING. Welding electrodes shall be provided as required for the applicable base metals and welding process. Fabrication of fittings shall be performed in accordance with the manufacturer's instructions.

### 3.2 EXPOSED PIPING INSTALLATION

Exposed piping shall be run as straight as practical along the alignment shown on the contract drawings and with a minimum of joints. Piping and appurtenances shall be installed in conformance with reviewed shop

drawings, manufacturer's instructions and ASME B31.3. Piping shall be installed without springing or forcing the pipe.

### 3.2.1 Anchors and Fasteners

Impact expansion (hammer and explosive charge drive-type) anchors and fastener systems are not acceptable. Lead shields, plastic or fiber inserts, and drilled-in plastic sleeve/nail drive systems are also not acceptable.

#### 3.2.1.1 Drilled-In Expansion Anchors and Fasteners

Anchors shall be designed to accept both machine bolts and/or threaded rods. Such anchors shall consist of an expansion shield and expander nut contained inside the shield. The expander nut shall be fabricated and designed to climb the bolt or rod thread and simultaneously expand the shield as soon as the threaded item, while being tightened, reaches, and bears against the shield bottom. The shield body shall consist of four legs, the inside of each shall be tapered toward shield bottom (or nut end). The end of one leg shall be elongated and turned across shield bottom. The outer surface of shield body shall be ribbed for grip-action. The expander nut shall be of square design with sides tapered inward from bottom to top. Fasteners shall be machine bolts for use with above anchors; nuts and washers shall conform to ASTM A 194/A 194M. The anchor length, diameter, and embedment depth shall meet the manufacturer's requirements for the maximum allowable working load of the application.

#### 3.2.1.2 Drilled-In Adhesive Anchors

Drilled-in adhesive anchors shall not be used for overhead applications. The anchors shall be composed of an anchor rod assembly and an anchor rod adhesive cartridge. The anchor rod assembly shall be a chamfered and threaded stud rod of TP304 stainless steel with a nut and washer of ASTM A 194/A 194M alloy-steel. The anchor length, diameter, and embedment depth shall meet the manufacturer's requirements for the maximum allowable working load of the application. The adhesive cartridge shall be a sealed capsule containing premeasured amounts of resin, quartz sand aggregate, and a hardener contained in a separate vial within the capsule. The capsule ingredients shall be activated by the insertion procedure of the anchor rod assembly.

### 3.2.2 Piping Expansion and Contraction Provisions

The piping shall be installed to allow for thermal expansion and contraction resulting from the difference between installation and operating temperatures. Design for installation of plastic pipe exposed to ambient conditions or in which the temperature variation of the contents is substantial shall have provisions for movement due to thermal expansion and contraction documented to be in accordance with PPI AW-32 TR21. Anchors shall be installed as shown in the contract drawings to withstand expansion thrust loads and to direct and control thermal expansion. An intermediate pipe guide shall be installed for every pipe at each metal channel framing support not carrying an anchor or alignment guide. Where pipe expansion joints are required, pipe alignment guides shall be installed adjacent to the expansion device and within four pipe diameters. Expansion devices shall be installed in accordance with the manufacturer's instructions.

### 3.2.3 Piping Flexibility Provisions

Thrust protection shall be provided as required. Flexible couplings and expansion joints shall be installed at connections to equipment, and where shown on the contract drawings. Additional pipe anchors and flexible couplings beyond those shown on the contract drawings, shall be provided to facilitate piping installation, in accordance with reviewed shop drawings.

#### 3.2.4 Couplings, Adapters and Service Saddles

Pipes shall be thoroughly cleaned of oil, scale, rust, and dirt in order to provide a clean seat for gaskets. Gaskets shall be wiped clean prior to installation. Flexible couplings and flanged coupling adapter gaskets shall be lubricated with soapy water or the manufacturer's standard lubricant before installation on the pipe ends. Couplings, service saddles, and anchor studs shall be installed in accordance with manufacturer's instructions. Bolts shall be tightened progressively, drawing up bolts on opposite sides a little at a time until all bolts have a uniform tightness. Torque-limiting wrenches shall be used to tighten bolts.

#### 3.2.5 Piping Equipment/Component Installation

Piping components and indicators shall be installed in accordance with manufacturer's instructions. Required upstream and downstream clearances, isolation valves, and miscellaneous devices shall be provided for an operable installation. Straight runs of piping upstream and downstream of flow measuring devices shall be as shown in the contract drawings and as recommended by device manufacturer. The upstream and downstream lengths of undisturbed piping shall be in accordance with flow indicator manufacturer's recommendations.

##### 3.2.5.1 Local Indicators

All direct-reading indicator devices, thermometers, and pressure gauges shall be installed so that they can be easily read from floor level, and are readily accessible for maintenance and service. All temperature sensing bulbs shall be coated with a silver base heat transfer grease prior to insertion into the thermowell. Pressure gauges and thermometers shall be installed where indicated in the contract drawings. Field calibration of all indicators shall be performed at time of installation to ensure measuring and reading accuracy. Differential pressure gauges shall be installed across the process equipment indicated in the contract drawings, in accordance with the manufacturer's recommendations, and arranged for easy observation.

##### 3.2.6 Pipe Flanges

Pipe flanges shall be set level, plumb, and aligned. Flanged fittings shall be installed true and perpendicular to the axis of the pipe. The bolt holes shall be concentric to the centerline of the pipe and shall straddle the vertical centerline of the pipe.

##### 3.2.7 Valve Locations

Valves shall be located in accordance with the contract drawings where actuators are shown. Where actuators are not shown, valves shall be located and oriented to permit easy access to the valve operator, and to avoid interferences.

##### 3.2.8 Pipe Tap Connections

Taps to pipe barrels are unacceptable except where specified. Taps to ductile iron piping shall be made only with a service saddle or at a tapping boss of a fitting, valve body, or equipment casting. Taps to steel piping shall be made only with a welded threadolet connection.

### 3.2.9 Plastic Pipe Installation

All plastic pipe shall be cut, made up, and installed in accordance with the pipe manufacturer's recommendations. Heat joining shall be performed in accordance with ASTM D 2657. Electrofusion joining shall be performed in accordance with ASTM F 1290. Schedule 40 pipe shall not be threaded. Schedule 80 threaded nipples shall be used where necessary to connect to threaded valves or fittings. Strap wrenches shall be used for tightening threaded plastic joints, and care shall be taken not to over tighten these fittings. Pipe shall not be laid when the temperature is below 40.1 degrees F, nor above 90 degrees F when exposed to direct sunlight. Any plastic pipe installed above grade and outdoors shall be ultraviolet (UV) protected or UV resistant. The pipe ends that are to be joined shall be shielded from direct sunlight prior to and during the laying operation. Adequate ventilation shall be provided when working with pipe joint solvent cement and the handling of solvent cements, primers and cleaners shall be in accordance with ASTM F 402. The Contractor shall provide and install supports and hangers in accordance with the manufacturer's recommendations and as indicated. Where plastic pipe is subjected to severe temperature fluctuations, provisions for expansion and contraction must be provided. This shall be accomplished with the use of expansion joints and offset piping arrangements. All lines shall be hydrostatically tested at the maximum operating pressures.

#### 3.2.9.1 PVC Piping

Solvent-cemented joints shall be constructed in accordance with ASTM D 2855.

### 3.3 BURIED PIPE PLACEMENT

#### 3.3.1 Excavation and Backfilling

Earthwork shall be performed as specified in Section 02316A EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Backfilling shall be accomplished after inspection by the Contracting Officer. The Contractor shall exercise care when lowering pipe into the trench to prevent damage or twisting of the pipe.

#### 3.3.2 Fittings

At valves and connections, the trench bottom shall be dug out with sufficient length, width, and depth to ensure clearance between the undisturbed trench bottom and the valves and such connections.

#### 3.3.3 Thrust Restraint

Thrust restraint devices are generally not shown in the contract drawings; their absence will not relieve Contractor of the responsibility for providing them as required to provide complete systems for the use intended. The Contractor shall provide thrust blocks and ties where required, whether or not shown on the contract drawings. At a minimum, thrust restraint shall be provided at pipeline tees, plugs, caps, bends, and other locations where unbalanced forces exist.

### 3.3.3.1 Thrust Blocks

Thrust blocking shall be concrete of a mix not leaner than 1 cement, 2.5 sand and 5 gravel, and have a compressive strength of not less than 2000 psi after 28 days. Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of the thrust blocks shall be poured against undisturbed earth. The sides of thrust blocks not subject to thrusts may be poured against forms. The area of bearing shall be as shown or directed. Blocking shall be placed so that fitting joints shall be accessible for repair. Steel rods and clamps, protected by galvanizing or a coating of bituminous paint shall be used to anchor vertical down bends into gravity thrust blocks.

### 3.3.3.2 Restrained Joints

For ductile iron pipe, restrained joints shall be designed by the Contractor or the pipe manufacturer in accordance with DIPRA-Restraint Design.

### 3.3.4 Marking Tape

Pipe marking tape shall be provided and installed in accordance with the requirements of Section 02316A EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

### 3.3.5 Plastic Pipe Installation

Plastic pipe shall be cut, fabricated, and installed in strict conformance with the pipe manufacturer's recommendations. Offset loops from the trench centerline shall be as recommended by the manufacturer for the maximum temperature variation between the pipe temperature at the time of solvent welding and operating temperature. Design for installation of plastic pipe exposed to ambient conditions or in which the temperature variation of the contents is substantial shall have provisions for movement due to thermal expansion and contraction documented to be in accordance with PPI AW-32 TR21.

Flexible plastic pipe connected to heavy fittings, manholes, and rigid structures shall be supported in such a manner that no subsequent relative movement between the plastic pipe at the flanged joint and the rigid structures is possible. Thrust blocking shall not be used for flexible plastic piping. The piping shall be designed and installed to withstand the compression and expansion forces imposed by the trench conditions.

## 3.4 CONNECTING DISSIMILAR PIPE

Flexible transition couplings, dielectric fittings and isolation joints shall be installed in accordance with the manufacturer's instructions.

## 3.5 EXTERNAL CORROSION PROTECTION

Protect all pipe and piping accessories from corrosion and adverse environmental conditions.

### 3.5.1 Underground Metallic Piping

Buried metallic piping shall be protected from corrosion using protective coatings and cathodic protection. Cathodic Protection shall be provided for metallic underground piping systems as specified in Section 13110A

CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE). Where dissimilar metals are joined underground, gas-tight isolation joints shall be used.

### 3.5.2 Above Grade Metallic Piping

Nonferrous and stainless steel piping shall not be painted except for aluminum alloy piping. Where dissimilar metals are joined, isolation joints shall be used.

#### 3.5.2.1 Ferrous Piping

Shop primed surfaces shall be touched up with ferrous metal primer. Surfaces that have not been shop primed shall be solvent cleaned. Surfaces that contain loose rust, mill scale or other foreign substances shall be mechanically cleaned by power wire brushing or commercial sand blasting conforming to SSPC SP 6 and primed with a ferrous metal primer. Primed surfaces shall be finished with two coats of exterior vinyl paint in accordance with Section 09900 PAINTS AND COATINGS. Cathodic Protection shall be provided as shown in the contract drawings for below ground ferrous piping systems as specified in Section 13110A CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE).

### 3.6 FLEXIBLE JOINTS AT CONCRETE STRUCTURES

Flexible joints shall be provided at the face of all structures, whether or not shown on the contract drawings. Rubber ring joints, mechanical joints, flexible couplings, and proprietary restrained ductile iron pipe joints shall be considered flexible joints; welded pipe joints shall not. Joints may be flush with the structure face or may be located up to 1 pipe diameter away from face, but not further than 17.7 inches away from face. For pipelines larger than 18 inches in diameter the first joint shall be within 1 pipe diameter.

### 3.7 CLOSURES

Closure pieces shall be installed as necessary to end pipe runs and shall conform to ASME B16.9 or ASME B16.11. Elastomer sleeves bonded to pipe ends are not acceptable. Pressure piping shall have closures of butt-welded caps or blind flanges, unless otherwise shown on contract drawings or approved by the Contracting Officer. Pipes with restrained joints shall have pipe closures installed with thrust tie-rod assemblies.

### 3.8 PENETRATIONS

Steel pipe sleeves shall be hot-dipped galvanized after fabrication for above grade applications in nonsubmerged areas. For below grade, or in submerged and damp environments, steel pipe sleeves shall be lined and coated as specified in Section 09900 PAINTS AND COATINGS. Embedded metallic piping shall be isolated from concrete reinforcement using coated pipe penetrations. Coatings shall be as specified in Section 09900 PAINTS AND COATINGS. Wall pipes shall be securely supported by form work to prevent contact with reinforcing steel and tie-wires. Joints shall be caulked with rubber sealant or sealed with a wall penetration seal. For existing concrete walls, rotary drilled holes may be provided in lieu of sleeves.

### 3.9 VALVE INSTALLATION

Flanged valve bolt holes shall be installed so as to straddle the vertical

centerline of pipe. Flanged faces shall be cleaned prior to inserting the gasket and bolts, and then the nuts shall be tightened progressively and uniformly. Threaded ends shall have the threads cleaned by wire brushing or swabbing prior to installation.

### 3.9.1 Valve Orientation

The operating stem of a manual valves shall be installed in a vertical position when the valve is installed in horizontal runs of pipe having centerline elevations 4.5 feet or less above finished floor, unless otherwise shown on contract drawings. The operating stem of a manual valve shall be installed in a horizontal position in horizontal runs of pipe having centerline elevations between 4.5 feet and 6.75 feet above finish floor, unless otherwise shown on contract drawings. Automatic valves shall be installed in accordance with the manufacturer's instructions and approved drawings.

#### 3.9.1.1 Butterfly Valves

Orientation of butterfly valves shall take into account changes in pipe direction. Valve shafts shall be oriented so that unbalanced flows caused by pipe direction changes or other disturbances are equally divided to each half of the disc.

#### 3.9.1.2 Plug Valves

If a plug valve seat position is not shown in the contract drawings, locate the seat position as follows: for horizontal flow, the flow shall produce an "unseating" pressure, and the plug shall open into the top half of valve; and for vertical flow, the seat shall be installed in the highest portion of the valve.

### 3.9.2 Line Size Ball Valves

A line size ball valve and union shall be installed upstream of each solenoid valve, in-line flow switch, or other in-line electrical device for isolation during maintenance.

### 3.9.3 Isolation Valve

Safety isolation valves shall be installed on compressed air supplies. The valve shall be located to provide accessibility for control and maintenance. If necessary, access doors shall be installed in finished walls and plaster ceilings for valve access.

### 3.9.4 Operator Extension Stems

Where the depth of the valve is such that its centerline is more than 3 feet below grade, or where otherwise indicated, an operator extension stem shall be furnished with a 2 inch operating nut to bring the operating nut to a point 5.9 inches below the surface of the ground and/or box cover. The operating nut shall be located in a floor box.

### 3.9.5 Chain Wheel and Guide

Chain wheel and guide assemblies or chain lever assemblies shall be installed on manually operated valves located over 6.73 feet above finished floor elevation. Where chains hang in normally traveled areas, appropriate tie-back anchors shall be used.

### 3.10 AIR RELEASE, DRAINS AND SAMPLE PORTS

Sample ports shall be provided where indicated on the contract drawings. The Contractor shall install specified vents at piping high points for entrapped air release and install drains in the low points of pipelines regardless of whether shown on contract drawings.

### 3.11 PIPING SUPPORT SYSTEMS INSTALLATION

The absence of pipe supports and details on the contract drawings shall not relieve the Contractor of responsibility for sizing and providing supports throughout plant.

#### 3.11.1 General Support Requirements

Pipe support systems shall meet the requirements of MSS SP-58. Contractor-designed and selected support systems shall be installed in accordance with MSS SP-69, and as specified herein. Piping connections to equipment shall be supported by pipe supports and not off the equipment. Large or heavy valves, fittings, and/or equipment shall be supported independently of associated piping. Pipes shall not be supported off other pipes. Supports shall be provided at piping changes in direction or in elevation, adjacent to flexible joints and couplings, and where otherwise shown on the contract drawings. Pipe supports and hangers shall not be installed in equipment access areas. Hanging pipes shall be braced against horizontal movement by both longitudinal and lateral sway bracing. At each channel type support, every pipe shall be provided with an intermediate pipe guide, except where pipe anchors are required. Existing support systems may be used to support additional new piping only if the Contractor can demonstrate that the existing support systems are adequate for the additional loads, or if the existing systems are strengthened to support the additional loads. Pedestal type pipe supports shall be provided under base flanges adjacent to rotating equipment and where required to isolate vibration. Piping 2.5 inches in diameter and larger shall be braced for seismic forces. Lateral supports for seismic loads shall be installed at all changes in direction.

#### 3.11.2 Dielectric Barriers

Dielectric barriers shall be installed between supports and copper or stainless steel piping, and between stainless steel supports and non-stainless steel ferrous piping.

### 3.12 PIPE IDENTIFICATION, PAINTING AND COLOR CODING

Color, coating, and lettering requirements for exposed piping shall be in accordance with Section 09900 PAINTS AND COATINGS. Except where piping is required to be completely painted in its code color, piping or its insulation covering may be banded either with plastic adhesive tapes or painted stripes around pipe designating piping contents in accordance with following options and requirements. A single individual band, of plastic adhesive tape or paint, designating pipe contents shall be provided with sufficient length to permit the stenciling of pipe contents in letters. Identification shall be provided at branch connections, inlets and outlets of equipment, every 19.7 feet of straight run, upstream of valves, and within 3.3 feet of entrance to or exit from wall curtains, or other similar type barrier.

### 3.13 FIELD QUALITY CONTROL

#### 3.13.1 Hydrostatic Tests

Where any section of a pipeline is provided with concrete thrust blocking for fitting, the hydrostatic tests shall not be made until at least 5 days after the installation of the concrete thrust blocking, unless otherwise approved by the Contracting Officer. Discharge valves shall be opened at high points to ensure that air is removed as the pipe is filled. Vent pipes shall be temporarily capped or plugged as required to enable pressurizing pipes. Pipes shall be filled slowly to prevent trapping and entraining air.

##### 3.13.1.1 Buried Piping

After the pipe is laid, the joints completed and the trench partially backfilled leaving the joints exposed for examination, the newly laid piping or any valved section of piping shall, unless otherwise specified, be subjected for 1 hour to a hydrostatic test pressure of 80 psig. Each valve shall be opened and closed several times during the test. Exposed pipe, joints, fittings, and valves shall be carefully examined during the partially open trench test. Joints showing visible leakage shall be replaced as necessary. Defective pipe, joints, fittings, and valves found during the pressure test shall be removed and replaced with new material, and the test repeated until the test results are satisfactory. The requirement for the joints to remain exposed for the hydrostatic tests may be waived by the Contracting Officer when one or more of the following conditions are encountered: (1) wet or unstable soil conditions in the trench; (2) compliance would require maintaining barricades and walkways around and across an open trench in a heavily used area that would require continuous surveillance to assure safe conditions; or (3) maintaining the trench in an open condition would delay completion of the Contract. The Contractor may request a waiver, setting forth in writing the reasons for the request and stating the alternative procedure proposed to comply with the hydrostatic tests. Backfill placed prior to the tests shall be placed in accordance with the requirements of Section 02316A EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

##### 3.13.1.2 Exposed Piping

Hydrostatic testing shall be conducted in accordance with ASME B31.3. Piping systems shall be tested under normal service conditions to demonstrate compliance. The test pressure shall not be less than 1.5 times the design pressure. Water shall be used as the hydrostatic test fluid. The Contractor shall provide clean test water of such quality to prevent corrosion of the piping system materials. Air release vents shall be opened at all high points of the piping system in order to purge air pockets while the piping system is filling.

- a. For rigid piping hydrostatic testing, the maximum test pressure shall be calculated according to ASME B31.3, but shall not exceed the yield strength of the piping system. The maximum velocity during filling shall be 0.25 fps applied over full area of pipe. Venting during filling may also be provided by loosening flanges with a minimum of four bolts or by the use of equipment vents. The Contractor shall test all parts of the piping system. The hydrostatic test pressure shall be maintained continuously for 30 minutes minimum and for such additional time as necessary to conduct examinations for leakage. All joints and connections

shall be examined by the Contractor for leakage. The piping system, exclusive of possible localized instances at pump or valve packing, shall show no visual evidence of leaking. The Contractor shall correct visible leakage and retest. Unless otherwise directed by the Contracting Officer, the piping system shall be left full of water after leaks are repaired.

- b. For non-rigid, non-metallic piping and metallic piping with a non-metallic liner hydrostatic testing, the maximum test pressure shall be calculated according to ASME B31.3, but shall not exceed 1.5 times the maximum pressure rating of the lowest rated component in the piping system. The maximum velocity during filling shall be 0.25 fps applied over full area of pipe. The system shall be initially pressurized to 50 percent of the normal service conditions and inspected. Any leaks shall be repaired by the Contractor. The system shall then be pressurized to the test pressure. Small amounts of water shall be added as required on a hourly basis for a maximum of 3 hours in order to maintain the test pressure. After 4 hours, the test pressure shall be lowered by 10.2 psi. If the hydrostatic pressure remains steady for 1 hour, then no leakage is indicated. The Contractor shall inspect for leaks, repair and retest if necessary. The piping system shall be allowed to relax for 8 hours before retesting.

#### 3.13.1.3 Time for Making Test

Except for joint material setting or where concrete thrust blocks necessitate a delay, underground piping jointed with rubber gaskets, mechanical or push-on joints, or couplings may be subjected to hydrostatic pressure, inspected, and tested for leakage at any time after partial completion of backfill. Tests for above ground pressure piping shall be conducted after the piping has been completely installed, including all supports, hangers, and anchors, and inspected for proper installation but prior to installation of insulation.

#### 3.13.2 Pipe Leakage Tests

Unless approved by the Contracting Officer, leakage testing shall be conducted after the pressure tests have been satisfactorily completed. The duration of each leakage test shall be at least 2 hours, and during the test the piping shall be subjected to not less than 80 psig pressure. Leakage is defined as the quantity of the test liquid, water, that is supplied to the piping system, or any valved or approved section thereof, in order to maintain pressure within 5 psi of the specified leakage test pressure after the piping has been filled with the test liquid and all air is expelled. No piping installation will be accepted if leakage exceeds the allowable leakage determined by the following formula:

$$L = C_f \times N \times D \times P^{0.5}$$

$C_f$  = conversion factor = 0.0001351  
 $L$  = allowable leakage, gallons per hour  
 $N$  = number of joints in the length of piping tested  
 $D$  = nominal pipe diameter, inches  
 $P$  = average test pressure during the test, psig.

Should any test disclose leakage greater than that allowed, the leaks shall be located and repaired until the leakage is within the specified allowance, without additional cost.

### 3.13.3 Testing New to Existing Connections

New piping connected to existing pipe, existing equipment, existing treatment systems, or tanks and treatment systems furnished under other Sections shall be tested. The Contractor shall isolate the new piping with pipe caps, spectacle blinds, or blind flanges. The joint between new piping and existing piping shall be tested by methods that do not place the entire existing system under the test load. The Contractor shall then proceed with the testing of new piping systems as specified herein.

### 3.13.4 Valve Testing

Valves may either be tested while testing pipelines, or as a separate step.

It shall be demonstrated that valves open and close smoothly with operating pressure on one side and atmospheric pressure on the other, and in both directions for two-way valve applications. The Contractor shall count and record the number of turns required to open and close each valve, and account for any discrepancies with manufacturer's data. Air and vacuum relief valves shall be examined as the associated pipe is being filled to verify venting and seating is fully functional. The Contractor shall set, verify, and record set pressures for all relief and regulating valves. Self-contained automatic valves shall be tested at both maximum and minimum operating ranges, and reset upon completion of test to the design value. Automatic valves that are not self-contained shall be tested in conjunction with control system testing.

## 3.14 FINAL CLEANING

### 3.14.1 Interim Cleaning

The Contractor shall prevent the accumulation of weld rod, weld spatter, pipe cuttings and filings, gravel, cleaning rags, and other foreign material within piping sections during fabrication. The piping shall be examined to assure removal of these and other foreign objects prior to assembly and installation.

### 3.14.2 Flushing

Following assembly and testing, and prior to final acceptance, piping systems shall be flushed with water to remove accumulated construction debris and other foreign matter. The piping shall be flushed until all foreign matter is removed from the pipeline. The Contractor shall provide all hoses, temporary pipes, ditches, and other items as required to properly dispose of flushing water without damage to adjacent properties. The minimum flushing velocity shall be 2.5 fps. For large diameter pipe where it is impractical to flush the pipe at the minimum flushing velocity, the pipeline shall be cleaned in-place from the inside by brushing and sweeping, then flushing the pipeline at a lower velocity. Cone strainers shall be installed in the flushing connections of attached equipment and left in place until cleaning is completed. Accumulated debris shall be removed through drains, or by removing spools or valves.

## 3.15 WASTE WATER DISPOSAL

The water used for testing, cleaning, and flushing shall be disposed of in accordance with all applicable regulations. Disposal is solely the responsibility of the Contractor. The method proposed for disposal of waste water shall be provided to, and approved by, the Contracting Officer prior to performing any testing, cleaning, flushing and disinfection

activities.

-- End of Section --

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## SECTION 15400A

PLUMBING, GENERAL PURPOSE  
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## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

- ARI 1010 (1994) Self-Contained, Mechanically Refrigerated Drinking-Water Coolers
- ARI 700 (1999) Specifications for Fluorocarbon and Other Refrigerants

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI Z21.10.3 (1998) Gas Water Heaters Vol.III, Storage Water Heaters With Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous Water Heaters
- ANSI Z21.22 (1999) Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems
- ANSI Z358.1 (1998) Emergency Eyewash and Shower Equipment

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM A 105/A 105M (2001) Carbon Steel Forgings for Piping Applications
- ASTM A 193/A 193M (2001b) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
- ASTM A 515/A 515M (2001) Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
- ASTM A 516/A 516M (2001) Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
- ASTM A 518/A 518M (1999) Corrosion-Resistant High-Silicon Iron Castings

ASTM A 53/A 53M	(2001) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 733	(2001) Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM A 74	(1998) Cast Iron Soil Pipe and Fittings
ASTM A 888	(1998e1) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
ASTM B 306	(1999) Copper Drainage Tube (DWV)
ASTM B 32	(2000) Solder Metal
ASTM B 370	(1998) Copper Sheet and Strip for Building Construction
ASTM B 42	(1998) Seamless Copper Pipe, Standard Sizes
ASTM B 43	(1998) Seamless Red Brass Pipe, Standard Sizes
ASTM B 584	(2000) Copper Alloy Sand Castings for General Applications
ASTM B 813	(2000) Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
ASTM B 828	(2000) Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
ASTM B 88	(1999e1) Seamless Copper Water Tube
ASTM B 88M	(1999) Seamless Copper Water Tube (Metric)
ASTM C 1053	(2000) Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications
ASTM C 564	(1997) Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C 920	(2002) Elastomeric Joint Sealants
ASTM D 1004	(1994a) Initial Tear Resistance of Plastic Film and Sheeting
ASTM D 2000	(2001) Rubber Products in Automotive Applications
ASTM D 2235	(2001) Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS)

## Plastic Pipe and Fittings

ASTM D 2564	(1996a) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2657	(1997) Heat Fusion Joining Polyolefin Pipe and Fittings
ASTM D 2661	(2001) Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D 2665	(2000) Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D 2822	(1991; R 1997e1) Asphalt Roof Cement
ASTM D 2855	(1996) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 2996	(2001) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D 3122	(1995) Solvent Cements for Styrene-Rubber (SR) Plastic Pipe and Fittings
ASTM D 3138	(1995) Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-Pressure Piping Components
ASTM D 3139	(1998) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D 3212	(1996a) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 3308	(2001) PTFE Resin Skived Tape
ASTM D 3311	(1994) Drain, Waste, and Vent (DWV) Plastic Fittings Patterns
ASTM D 4101	(2002) Propylene Plastic Injection and Extrusion Materials
ASTM D 4551	(1996; R 2001) Poly(Vinyl Chloride) (PVC) Plastic Flexible Concealed Water-Containment Membrane
ASTM D 638	(2001) Tensile Properties of Plastics
ASTM E 1	(2001) ASTM Thermometers
ASTM E 96	(2000e1) Water Vapor Transmission of Materials

ASTM F 1290	(1998a) Electrofusion Joining Polyolefin Pipe and Fittings
ASTM F 1760	(2001) Coextruded Poly(Vinyl Chloride) (PVC) Non-Pressure Plastic Pipe Having Reprocessed-Recycled Content
ASTM F 409	(1999a) Thermoplastic Accessible and Replaceable Plastic Tube and Tubular Fittings
ASTM F 477	(1999) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 493	(1997) Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
ASTM F 628	(2001) Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe with a Cellular Core
ASTM F 891	(2000) Coextruded Poly (Vinyl chloride) (PVC) Plastic Pipe with a Cellular Core

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 34	(2001; Errata 2002) Number Designation and Safety Classification of Refrigerants
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AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1001	(2002) Pipe Applied Atmospheric Type Vacuum Breakers
ASSE 1003	(2001) Water Pressure Reducing Valves
ASSE 1005	(1999) Water Heater Drain Valves
ASSE 1011	(1993) Hose Connection Vacuum Breakers
ASSE 1012	(1993) Backflow Preventers with Intermediate Atmospheric Vent
ASSE 1013	(1999) Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers
ASSE 1018	(2001) Trap Seal Primer Valves, Water Supply Fed
ASSE 1020	(1998) Pressure Vacuum Breaker Assembly
ASSE 1037	(1990; Rev thru Mar 1990) Pressurized Flushing Devices (Flushometers) for Plumbing Fixtures

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA B300	(1999) Hypochlorites
AWWA B301	(1999) Liquid Chlorine
AWWA C105	(1999) Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C203	(1997; C203a99) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C606	(1997) Grooved and Shouldered Joints
AWWA C700	(1995) Cold-Water Meters - Displacement Type, Bronze Main Case
AWWA C701	(1988) Cold-Water Meters - Turbine Type, for Customer Service
AWWA EWW	(1998) Standard Methods for the Examination of Water and Wastewater
AWWA M20	(1973) Manual: Water Chlorination Principles and Practices
AMERICAN WELDING SOCIETY (AWS)	
AWS A5.8	(1992) Filler Metals for Brazing and Braze Welding
AWS B2.2	(1991) Brazing Procedure and Performance Qualification
ASME INTERNATIONAL (ASME)	
ASME A112.1.2	(1991; R 1998) Air Gaps in Plumbing Systems
ASME A112.14.1	(1975; R 1998) Backwater Valves
ASME A112.18.1M	(2000) Plumbing Fixture Fittings
ASME A112.19.1M	(1994; R 1999) Enameled Cast Iron Plumbing Fixtures
ASME A112.19.2M	(1998) Vitreous China Plumbing Fixtures
ASME A112.19.3M	(2001) Stainless Steel Fixtures (Designed for Residential Use)
ASME A112.21.1M	(1991; R 1998) Floor Drains
ASME A112.36.2M	(1991; R 1998) Cleanouts
ASME A112.6.1M	(1997) Floor Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use
ASME B1.20.1	(1983; R 2001) Pipe Threads, General

	Purpose (Inch)
ASME B16.12	(1998) Cast Iron Threaded Drainage Fittings
ASME B16.15	(1985; R 1994) Cast Bronze Threaded Fittings Classes 125 and 250
ASME B16.18	(2001) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(1995) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.23	(1992) Cast Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.24	(2002) Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 400, 600, 900, 1500, and 2500
ASME B16.29	(2001) Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.3	(1998) Malleable Iron Threaded Fittings
ASME B16.34	(1996) Valves Flanged, Threaded, and Welding End
ASME B16.39	(1998) Malleable Iron Threaded Pipe Unions
ASME B16.4	(1998) Gray Iron Threaded Fittings
ASME B16.5	(1996) Pipe Flanges and Flanged Fittings
ASME B31.1	(2001) Power Piping
ASME B31.5	(2001) Refrigeration Piping and Heat Transfer Components
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element
ASME BPVC SEC VIII D1	(2001) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage
ASME BPVC SEC IX	(2001) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications
ASME CSD-1	(2002) Control and Safety Devices for Automatically Fired Boilers
CAST IRON SOIL PIPE INSTITUTE (CISPI)	
CISPI 301	(2000) Hubless Cast Iron Soil Pipe and

	Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
CISPI 310	(1997) Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
CISPI HSN-85	(1985) Neoprene Rubber Gaskets for Hub and Spigot Cast Iron Soil Pipe and Fittings
COPPER DEVELOPMENT ASSOCIATION (CDA)	
CDA Tube A 4015	(1994; R 1995) Copper Tube Handbook
FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)	
FCCCHR-CCC	(9th Edition) Manual of Cross-Connection Control
HYDRAULIC INSTITUTE (HI)	
HI 1.1-1.5	(1994) Centrifugal Nomenclature
INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS (IAPMO)	
IAPMO Z124.1	(1995) Plastic Bathtub Units
IAPMO Z124.5	(1997) Plastic Toilet (Water Closets) Seats
INTERNATIONAL CODE COUNCIL (ICC)	
CABO A117.1	(1998) Accessible and Usable Buildings and Facilities
MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)	
MSS SP-110	(1996) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
MSS SP-25	(1998) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-44	(1996; R 2001) Steel Pipe Line Flanges
MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-67	(2002) Butterfly Valves
MSS SP-69	(1996) Pipe Hangers and Supports - Selection and Application
MSS SP-70	(1998) Cast Iron Gate Valves, Flanged and Threaded Ends

MSS SP-71	(1997) Gray Iron Swing Check Valves, Flanges and Threaded Ends
MSS SP-72	(1999) Ball Valves with Flanged or Butt-Welding Ends for General Service
MSS SP-73	(1991; R 1996) Brazing Joints for Copper and Copper Alloy Pressure Fittings
MSS SP-78	(1998) Cast Iron Plug Valves, Flanged and Threaded Ends
MSS SP-80	(1997) Bronze Gate, Globe, Angle and Check Valves
MSS SP-83	(1995) Class 3000 Steel Pipe Unions Socket-Welding and Threaded
MSS SP-85	(1994) Cast Iron Globe & Angle Valves, Flanged and Threaded Ends
NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)	
NEMA 250	(1997) Enclosures for Electrical Equipment (1000 Volts Maximum)
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 54	(1999) National Fuel Gas Code
NFPA 90A	(1999) Installation of Air Conditioning and Ventilating Systems
NSF INTERNATIONAL (NSF)	
NSF 14	(2002) Plastics Piping Components and Related Materials
NSF 61	(1999;2001 Addendum 1 - Sep 2001) Drinking Water System Components - Health Effects
PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)	
PPFA-01	(1998) Plastic Pipe in Fire Resistive Construction
PLUMBING AND DRAINAGE INSTITUTE (PDI)	
PDI WH 201	(1992) Water Hammer Arresters
PLUMBING-HEATING-COOLING CONTRACTORS NATIONAL ASSOCIATION (PHCC)	
NAPHCC Plumbing Code	(2000) National Standard Plumbing Code
SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)	
SAE J 1508	(1997) Hose Clamp Specifications

## U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-240 (Rev A; Canc. Notice 1) Shower Head, Ball Joint

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

10 CFR 430 Energy Conservation Program for Consumer Products

PL 93-523 (1974; Amended 1986) Safe Drinking Water Act

## UNDERWRITERS LABORATORIES (UL)

UL 430 (1994; Rev thru Mar 2001) Waste Disposers

## 1.2 STANDARD PRODUCTS

Specified materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products. Specified equipment shall essentially duplicate equipment that has performed satisfactorily at least two years prior to bid opening.

## 1.3 ELECTRICAL WORK

Motors, motor controllers and motor efficiencies shall conform to the requirements of Section 16415A ELECTRICAL WORK, INTERIOR. Electrical motor-driven equipment specified herein shall be provided complete with motors. Equipment shall be rated at 60 Hz, single phase, ac unless otherwise indicated. Where a motor controller is not provided in a motor-control center on the electrical drawings, a motor controller shall be as indicated. Motor controllers shall be provided complete with properly sized thermal-overload protection in each ungrounded conductor, auxiliary contact, and other equipment, at the specified capacity, and including an allowable service factor.

## 1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Plumbing System; G-DO.

Detail drawings consisting of illustrations, schedules, performance charts, instructions, brochures, diagrams, and other information to illustrate the requirements and operations of each system. Detail drawings for the complete plumbing system including piping layouts and locations of connections; dimensions for roughing-in, foundation, and support points; schematic diagrams and wiring diagrams or connection and interconnection diagrams. Detail drawings shall indicate clearances required for maintenance and operation. Where piping and equipment are to be

supported other than as indicated, details shall include loadings and proposed support methods. Mechanical drawing plans, elevations, views, and details, shall be drawn to scale.

#### SD-03 Product Data

Welding; G-AO.

A copy of qualified procedures and a list of names and identification symbols of qualified welders and welding operators.

Plumbing Fixture Schedule; G-DO.

Catalog cuts of specified plumbing fixtures system and system location where installed.

Vibration-Absorbing Features; G-AO.

Details of vibration-absorbing features, including arrangement, foundation plan, dimensions and specifications.

Plumbing System; G-AO.

Diagrams, instructions, and other sheets proposed for posting. Manufacturer's recommendations for the installation of bell and spigot and hubless joints for cast iron soil pipe.

#### SD-06 Test Reports

Tests, Flushing and Disinfection; G-AO.

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, completion and testing of the installed system. Each test report shall indicate the final position of controls.

Backflow Prevention Assembly Tests; G-AO.

Certification of proper operation shall be as accomplished in accordance with state regulations by an individual certified by the state to perform such tests. If no state requirement exists, the Contractor shall have the manufacturer's representative test the device, to ensure the unit is properly installed and performing as intended. The Contractor shall provide written documentation of the tests performed and signed by the individual performing the tests.

#### SD-07 Certificates

Materials and Equipment; G-AO.

Where materials or equipment are specified to comply with requirements of AGA, ASME, or NSF proof of such compliance shall be included. The label or listing of the specified agency will be acceptable evidence. In lieu of the label or listing, a written certificate may be submitted from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the

requirements and testing methods of the specified agency. Where equipment is specified to conform to requirements of the ASME Boiler and Pressure Vessel Code, the design, fabrication, and installation shall conform to the code.

Bolts; G-AO.

Written certification by the bolt manufacturer that the bolts furnished comply with the specified requirements. The certification shall include illustrations of product-required markings, the date of manufacture, and the number of each type of bolt to be furnished based on this certification.

#### SD-10 Operation and Maintenance Data

Plumbing System; G-AO.

Six copies of the operation manual outlining the step-by-step procedures required for system startup, operation and shutdown. The manual shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Six copies of the maintenance manual listing routine maintenance procedures, possible breakdowns and repairs. The manual shall include piping and equipment layout and simplified wiring and control diagrams of the system as installed.

### 1.5 PERFORMANCE REQUIREMENTS

#### 1.5.1 Welding

Piping shall be welded in accordance with qualified procedures using performance-qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPVC SEC IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer, may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests, and the tests shall be performed at the work site if practicable. Welders or welding operators shall apply their assigned symbols near each weld they make as a permanent record. Welding and nondestructive testing procedures are specified in Section 05093A WELDING PRESSURE PIPING.

#### 1.5.2 Cathodic Protection and Pipe Joint Bonding

Cathodic protection and pipe joint bonding systems shall be in accordance with Section 13110A CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE).

### 1.6 REGULATORY REQUIREMENTS

Plumbing work shall be in accordance with ICC International Plumbing Code and State codes.

### 1.7 PROJECT/SITE CONDITIONS

The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

## PART 2 PRODUCTS

## 2.1 MATERIALS

Materials for various services shall be in accordance with TABLES I and II at the end of this specification. Pipe schedules shall be selected based on service requirements. Pipe fittings shall be compatible with the applicable pipe materials. Plastic pipe, fittings, and solvent cement shall meet NSF 14 and shall be NSF listed for the service intended. Plastic pipe, fittings, and solvent cement used for potable hot and cold water service shall bear the NSF seal "NSF-PW." Polypropylene pipe and fittings shall conform to dimensional requirements of Schedule 40, Iron Pipe size. Pipe threads (except dry seal) shall conform to ASME B1.20.1. Grooved pipe couplings and fittings shall not be used. Material or equipment containing lead shall not be used in any potable water system. In line devices such as water meters, building valves, check valves, meter stops, valves, fittings and back flow preventers shall comply with PL 93-523 and NSF 61, Section 8. End point devices such as drinking water fountains, lavatory faucets, kitchen and bar faucets, residential ice makers, supply stops and end point control valves used to dispense water for drinking must meet the requirements of NSF 61, Section 9. Hubless cast-iron soil pipe shall not be installed underground, under concrete floor slabs, or in crawl spaces below kitchen floors. Plastic pipe shall not be installed in air plenums. Plastic pipe shall not be installed in a pressure piping system in buildings greater than three stories including any basement levels.

### 2.1.1 Pipe Joint Materials

Hubless cast-iron soil pipe shall not be used under ground. Joints and gasket materials shall conform to the following:

- a. Coupling for Cast-Iron Pipe: for hub and spigot type ASTM A 74, AWWA C606. For hubless type: CISPI 310
- b. Coupling for Steel Pipe: AWWA C606.

#### Not Used.

- d. Flange Gaskets: Gaskets shall be made of non-asbestos material in accordance with ASME B16.21. Gaskets shall be flat, 1/16 inch thick, and contain Aramid fibers bonded with Styrene Butadiene Rubber (SBR) or Nitro Butadiene Rubber (NBR). Gaskets shall be the full face or self centering flat ring type. Gaskets used for hydrocarbon service shall be bonded with NBR.
- e. Neoprene Gaskets for Hub and Cast-Iron Pipe and Fittings: CISPI HSN-85.
- f. Brazing Material: Brazing material shall conform to AWS A5.8, BCuP-5.
- g. Brazing Flux: Flux shall be in paste or liquid form appropriate for use with brazing material. Flux shall be as follows: lead-free; have a 100 percent flushable residue; contain slightly acidic reagents; contain potassium borides; and contain fluorides.
- h. Solder Material: Solder metal shall conform to ASTM B 32.
- i. Solder Flux: Flux shall be liquid form, non-corrosive, and

conform to ASTM B 813, Standard Test 1.

- j. PTFE Tape: PTFE Tape, for use with Threaded Metal or Plastic Pipe, ASTM D 3308.
- k. Rubber Gaskets for Cast-Iron Soil-Pipe and Fittings (hub and spigot type and hubless type): ASTM C 564.
- l. Rubber Gaskets for Grooved Pipe: ASTM D 2000, maximum temperature 230 degrees F.
- m. Flexible Elastomeric Seals: ASTM D 3139, ASTM D 3212 or ASTM F 477.
- n. Not Used.
- o. Solvent Cement for Transition Joints between ABS and PVC Nonpressure Piping Components: ASTM D 3138.
- p. Plastic Solvent Cement for ABS Plastic Pipe: ASTM D 2235.
- q. Plastic Solvent Cement for PVC Plastic Pipe: ASTM D 2564 and ASTM D 2855.
- r. Plastic Solvent Cement for CPVC Plastic Pipe: ASTM F 493.
- s. Flanged fittings including flanges, bolts, nuts, bolt patterns, etc., shall be in accordance with ASME B16.5 class 150 and shall have the manufacturer's trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A 105/A 105M. Blind flange material shall conform to ASTM A 516/A 516M cold service and ASTM A 515/A 515M for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A 193/A 193M.
- t. Plastic Solvent Cement for Styrene Rubber Plastic Pipe: ASTM D 3122.

#### 2.1.2 Miscellaneous Materials

Miscellaneous materials shall conform to the following:

- a. Water Hammer Arrester: PDI WH 201.
- b. Copper, Sheet and Strip for Building Construction: ASTM B 370.
- c. Asphalt Roof Cement: ASTM D 2822.
- d. Hose Clamps: SAE J 1508.
- e. Supports for Off-The-Floor Plumbing Fixtures: ASME A112.6.1M.
- f. Metallic Cleanouts: ASME A112.36.2M.
- g. Plumbing Fixture Setting Compound: A preformed flexible ring seal molded from hydrocarbon wax material. The seal material shall be nonvolatile nonasphaltic and contain germicide and provide watertight, gastight, odorproof and verminproof properties.
- h. Coal-Tar Protective Coatings and Linings for Steel Water Pipelines:

AWWA C203.

- i. Hypochlorites: AWWA B300.
- j. Liquid Chlorine: AWWA B301.
- k. Polyethylene Encasement for Ductile-Iron Piping: AWWA C105.
- l. Gauges - Pressure and Vacuum Indicating Dial Type - Elastic Element: ASME B40.1.
- m. Thermometers: ASTM E 1. Mercury shall not be used in thermometers.

### 2.1.3 Pipe Insulation Material

Insulation shall be as specified in Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS.

## 2.2 PIPE HANGERS, INSERTS, AND SUPPORTS

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

## 2.3 VALVES

Valves shall be provided on supplies to equipment and fixtures. Valves 2-1/2 inches and smaller shall be bronze with threaded bodies for pipe and solder-type connections for tubing. Valves 3 inches and larger shall have flanged iron bodies and bronze trim. Pressure ratings shall be based upon the application. Grooved end valves may be provided if the manufacturer certifies that the valves meet the performance requirements of applicable MSS standard. Valves shall conform to the following standards:

Description	Standard
Butterfly Valves	MSS SP-67
Cast-Iron Gate Valves, Flanged and Threaded Ends	MSS SP-70
Cast-Iron Swing Check Valves, Flanged and Threaded Ends	MSS SP-71
Ball Valves with Flanged Butt-Welding Ends for General Service	MSS SP-72
Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends	MSS SP-110
Cast-Iron Plug Valves, Flanged and Threaded Ends	MSS SP-78
Bronze Gate, Globe, Angle, and Check Valves	MSS SP-80
Steel Valves, Socket Welding and Threaded Ends	ASME B16.34
Cast-Iron Globe and Angle Valves, Flanged and Threaded Ends	MSS SP-85

Description	Standard
Backwater Valves	ASME A112.14.1
Vacuum Relief Valves	ANSI Z21.22
Water Pressure Reducing Valves	ASSE 1003
Water Heater Drain Valves	ASSE 1005
Trap Seal Primer Valves	ASSE 1018
Temperature and Pressure Relief Valves for Hot Water Supply Systems	ANSI Z21.22
Temperature and Pressure Relief Valves for Automatically Fired Hot Water Boilers	ASME CSD-1  Safety Code No., Part CW, Article 5

#### 2.3.1 Backwater Valves

Backwater valves shall be either separate from the floor drain or a combination floor drain, P-trap, and backwater valve, as shown. Valves shall have cast-iron bodies with cleanouts large enough to permit removal of interior parts. Valves shall be of the flap type, hinged or pivoted, with revolving disks. Hinge pivots, disks, and seats shall be nonferrous metal. Disks shall be slightly open in a no-flow no-backwater condition. Cleanouts shall extend to finished floor and be fitted with threaded countersunk plugs.

#### 2.3.2 Hose Bibbs

Hose Bibbs with vacuum-breaker backflow preventer shall be brass with 3/4 inch male inlet threads, hexagon shoulder, and 3/4 inch hose connection. Faucet handle shall be securely attached to stem.

#### 2.3.3 Wall Hydrants

Wall hydrants with vacuum-breaker backflow preventer shall have a nickel-brass or nickel-bronze wall plate or flange with nozzle and detachable key handle. A brass or bronze operating rod shall be provided within a galvanized iron casing of sufficient length to extend through the wall so that the valve is inside the building, and the portion of the hydrant between the outlet and valve is self-draining. A brass or bronze valve with coupling and union elbow having metal-to-metal seat shall be provided. Valve rod and seat washer shall be removable through the face of the hydrant. The hydrant shall have 3/4 inch exposed hose thread on spout and 3/4 inch male pipe thread on inlet.

#### 2.3.4 Not Used

#### 2.3.5 Not Used

#### 2.3.6 Relief Valves

Water heaters and hot water storage tanks shall have a combination pressure and temperature (P&T) relief valve. The pressure relief element of a P&T

relief valve shall have adequate capacity to prevent excessive pressure buildup in the system when the system is operating at the maximum rate of heat input. The temperature element of a P&T relief valve shall have a relieving capacity which is at least equal to the total input of the heaters when operating at their maximum capacity. Relief valves shall be rated according to ANSI Z21.22. Relief valves for systems where the maximum rate of heat input is less than 200,000 Btuh shall have 3/4 inch minimum inlets, and 3/4 inch outlets. Relief valves for systems where the maximum rate of heat input is greater than 200,000 Btuh shall have 1 inch minimum inlets, and 1 inch outlets. The discharge pipe from the relief valve shall be the size of the valve outlet.

2.3.7 Not Used.

## 2.4 FIXTURES

Fixtures shall be water conservation type, in accordance with ICC International Plumbing Code. Fixtures for use by the physically handicapped shall be in accordance with CABO A117.1. Vitreous china, nonabsorbent, hard-burned, and vitrified throughout the body shall be provided. Porcelain enameled ware shall have specially selected, clear white, acid-resisting enamel coating evenly applied on surfaces. No fixture will be accepted that shows cracks, crazes, blisters, thin spots, or other flaws. Fixtures shall be equipped with appurtenances such as traps, faucets, stop valves, and drain fittings. Each fixture and piece of equipment requiring connections to the drainage system, except grease interceptors, shall be equipped with a trap. Brass expansion or toggle bolts capped with acorn nuts shall be provided for supports, and polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Fixtures with the supply discharge below the rim shall be equipped with backflow preventers. Internal parts of flush and/or flushometer valves, shower mixing valves, shower head face plates, pop-up stoppers of lavatory waste drains, and pop-up stoppers and overflow tees and shoes of bathtub waste drains may contain acetal resin, fluorocarbon, nylon, acrylonitrile-butadiene-styrene (ABS) or other plastic material, if the material has provided satisfactory service under actual commercial or industrial operating conditions for not less than 2 years. Plastic in contact with hot water shall be suitable for 180 degrees F water temperature. Plumbing fixtures shall be as indicated in paragraph PLUMBING FIXTURE SCHEDULE.

### 2.4.1 Lavatories

Vitreous china lavatories shall be provided with two integral molded lugs on the back-underside of the fixture and drilled for bolting to the wall in a manner similar to the hanger plate.

2.4.2 Not Used.

## 2.5 BACKFLOW PREVENTERS

Backflow preventers shall be approved and listed by the Foundation For Cross-Connection Control & Hydraulic Research. Reduced pressure principle assemblies, double check valve assemblies, atmospheric (nonpressure) type vacuum breakers, and pressure type vacuum breakers shall be tested, approved, and listed in accordance with FCCCHR-CCC. Backflow preventers with intermediate atmospheric vent shall conform to ASSE 1012. Reduced pressure principle backflow preventers shall conform to ASSE 1013. Hose

connection vacuum breakers shall conform to ASSE 1011. Pipe applied atmospheric type vacuum breakers shall conform to ASSE 1001. Pressure vacuum breaker assembly shall conform to ASSE 1020. Air gaps in plumbing systems shall conform to ASME A112.1.2.

## 2.6 DRAINS

### 2.6.1 Floor Drain (FD-1) and Shower Drains

Floor and shower drains shall consist of a galvanized body, integral seepage pan, and adjustable perforated or slotted chromium-plated bronze, nickel-bronze, or nickel-brass strainer, consisting of grate and threaded collar. Floor drains shall be cast iron except where metallic waterproofing membrane is installed. Drains shall be of double drainage pattern for embedding in the floor construction. The seepage pan shall have weep holes or channels for drainage to the drainpipe. The strainer shall be adjustable to floor thickness. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or waterproofing membrane shall be provided when required. Drains shall be provided with threaded connection. The outlet size shall be 2 inch. Between the drain outlet and waste pipe, a neoprene rubber gasket conforming to ASTM C 564 may be installed, provided that the drain is specifically designed for the rubber gasket compression type joint. Floor and shower drains shall conform to ASME A112.21.1M.

2.6.1.1 Not Used.

2.6.1.2 Not Used.

2.6.2 Not Used.

2.6.3 Not Used.

### 2.6.4 Boiler Room Drains (FD-2)

Boiler room drains shall have combined drain and trap, hinged grate, removable bucket, and threaded brass cleanout. The removable galvanized cast-iron sediment bucket shall have rounded corners to eliminate fouling and shall be equipped with hand grips. Drain shall have a minimum water seal of 4 inches. The grate area shall be not less than 64 square inches. The outlet pipe size shall be 3 inch.

### 2.6.5 Floor Sinks (FD-3)

Floor sinks shall be square, with 12 inch nominal overall width or diameter and 10 inch nominal overall depth. Floor sink shall have an acid-resistant enamel interior finish with cast-iron body, aluminum sediment bucket, and perforated grate of cast iron in industrial areas and stainless steel in finished areas. The outlet pipe size shall be 3 inch unless shown otherwise as 2 inch.

### 2.6.4 Boiler Room Drains (FD-4)

Same as boiler room drains (FD-2) above, except outlet pipe size shall be 4 inch.

### 2.6.6 Sight Drains (FD-5)

Sight drains shall consist of body, integral seepage pan, and adjustable

strainer with perforated or slotted grate and funnel extension. Outlet size shall be 2 inch. The strainer shall have a threaded collar to permit adjustment to floor thickness. Drains shall be of double drainage pattern suitable for embedding in the floor construction. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or membrane shall be provided for other than concrete construction. Drains shall have a galvanized heavy cast-iron body and seepage pan and chromium-plated bronze, nickel-bronze, or nickel-brass strainer and funnel combination. Drains shall be provided with threaded connection and with a separate cast-iron "P" trap, unless otherwise indicated. Drains shall be circular, unless otherwise indicated. The funnel shall be securely mounted over an opening in the center of the strainer. Minimum dimensions shall be as follows:

Area of strainer and collar	36 square inches
Height of funnel	3-3/4 inches
Diameter of lower portion of funnel	2 inches
Diameter of upper portion of funnel	4 inches

2.6.7 Not Used.

#### 2.7 SHOWER PAN

Shower shall be nonmetallic material.

2.7.1 Not Used.

#### 2.7.2 Plasticized Polyvinyl Chloride Shower Pan Material

Material shall be sheet form. The material shall be 0.040 inch minimum thickness of plasticized polyvinyl chloride or chlorinated polyethylene and shall be in accordance with ASTM D 4551.

#### 2.7.3 Nonplasticized Polyvinyl Chloride (PVC) Shower Pan Material

Material shall consist of a plastic waterproofing membrane in sheet form. The material shall be 0.040 inch minimum thickness of nonplasticized PVC and shall have the following minimum properties:

a. or ASTM D 638:

Ultimate Tensile Strength:	2600 psi
Ultimate Elongation:	398 percent
100 Percent Modulus:	445 psi

b. ASTM D 1004:

Tear Strength:	300 pounds per inch
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c. ASTM E 96:

Permeance:	0.008 perms
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d. Other Properties:

Specific Gravity:	1.29
PVC Solvent:	Weldable
Cold Crack:	minus -53 degrees F
Dimensional stability, 212 degrees F minus 2.5 percent	
Hardness, Shore A:	89

## 2.8 TRAPS

Unless otherwise specified, traps shall be plastic per ASTM F 409 or copper-alloy adjustable tube type with slip joint inlet and swivel. Traps shall be without a cleanout. Tubes shall be copper alloy with walls not less than 0.032 inch thick within commercial tolerances, except on the outside of bends where the thickness may be reduced slightly in manufacture by usual commercial methods. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level. Swivel joints shall be below the discharge level and shall be of metal-to-metal or metal-to-plastic type as required for the application. Nuts shall have flats for wrench grip. Outlets shall have internal pipe thread, except that when required for the application, the outlets shall have sockets for solder-joint connections. The depth of the water seal shall be not less than 2 inches. The interior diameter shall be not more than 1/8 inch over or under the nominal size, and interior surfaces shall be reasonably smooth throughout. A copper alloy "P" trap assembly consisting of an adjustable "P" trap and threaded trap wall nipple with cast brass wall flange shall be provided for lavatories. The assembly shall be a standard manufactured unit and may have a rubber-gasketed swivel joint.

## 2.9 NOT USED.

## 2.10 WATER HEATERS

Water heater types and capacities shall be as indicated. Burners shall be atmospheric type. Each water heater shall have replaceable anodes. Each primary water heater shall have controls with an adjustable range that includes 90 to 160 degrees F. Each gas-fired water heater and booster water heater shall have controls with an adjustable range that includes 120 to 180 degrees F. Hot water systems utilizing recirculation systems shall be tied into building off-hour controls. The thermal efficiencies and standby heat losses shall conform to TABLE III for each type of water heater specified. The only exception is that storage water heaters and hot water storage tanks having more than 500 gallons storage capacity need not meet the standard loss requirement if the tank surface area is insulated to R-12.5 and if a standing light is not used. Plastic materials polyetherimide (PEI) and polyethersulfone (PES) are forbidden to be used for vent piping of combustion gases.

### 2.10.1 Automatic Storage Type

Heaters shall be complete with control system, temperature gauge, and pressure gauge, and shall have ASME rated combination pressure and temperature relief valve.

#### 2.10.1.1 Venting

Atmospheric draft burners shall be vented using UL listed Type B vents.

#### 2.10.1.2 Gas-Fired Type

Gas-fired water heaters shall conform to ANSI Z21.10.3 for heaters with input greater than 75,000 BTU per hour.

2.10.1.3 Not Used

2.11 NOT USED.

2.12 PUMPS

2.12.1 Not Used.

2.12.2 Circulating Pumps

Domestic hot water circulating pumps shall be electrically driven, single-stage, centrifugal, with mechanical seals, suitable for the intended service. Pump capacities, efficiencies, motor sizes, speeds, and impeller types shall be as shown. Pump and motor shall be supported by the piping on which it is installed. The shaft shall be one-piece, heat-treated, corrosion-resisting steel with impeller and smooth-surfaced housing of bronze. Motor shall be totally enclosed, fan-cooled and shall have sufficient horsepower for the service required. Pump shall conform to HI 1.1-1.5. Each pump motor shall be equipped with an across-the-line magnetic controller in a NEMA 250, Type 1 enclosure with "START-STOP" switch in cover. Pump motors smaller than Fractional horsepower pump motors shall have integral thermal overload protection in accordance with Section 16415A ELECTRICAL WORK, INTERIOR. Guards shall shield exposed moving parts.

2.12.3 Not Used

2.12.4 Not Used.

2.13 COMPRESSED AIR SYSTEM

2.13.1 Air Compressors

Air compressor unit shall be a factory-packaged assembly, including Three phase, 460 volt motor controls, switches, wiring, accessories, and motor controllers, in a NEMA 250, Type 1 enclosure. Tank-mounted air compressors shall be manufactured to comply with UL listing requirements. Air compressors shall have manufacturer's name and address, together with trade name, and catalog number on a nameplate securely attached to the equipment.

Each compressor shall have a manual-off-automatic switch that when in the manual position, the compressor loads and unloads to meet the demand and, in the automatic position, a time delay relay shall allow the compressor to operate for an adjustable length of time unloaded, then stop the unit. Guards shall shield exposed moving parts. Each duplex compressor system shall be provided with automatic alternation system. Each compressor motor shall be provided with an across-the-line-type magnetic controller, complete with low-voltage release. An intake air filter and silencer shall be provided with each compressor. Aftercooler and moisture separator shall be installed between compressors and air receiver to remove moisture and oil condensate before the air enters the receiver. Aftercoolers shall be either air- or water-cooled, as indicated. The air shall pass through a sufficient number of tubes to affect cooling. Tubes shall be sized to give maximum heat transfer. Water to unit shall be controlled by a solenoid or pneumatic valve, which opens when the compressors start and closes when the

compressors shut down. Cooling capacity of the aftercooler shall be sized for the total capacity of the compressors. Means shall be provided for draining condensed moisture from the receiver by an automatic float type trap. Capacities of air compressors and receivers shall be as indicated.

#### 2.13.2 Lubricated Compressors

Compressors shall be two-stage, V-belt drive, capable of operating continuously against their designed discharge pressure, and shall operate at a speed not in excess of 1800 rpm. Compressors shall have the capacity and discharge pressure indicated. Compressors shall be assembled complete on a common subbase. The compressor main bearings shall be either roller or ball. The discharge passage of the high pressure air shall be piped to the air receiver with a copper pipe or tubing. A pressure gauge calibrated to 150 psi and equipped with a gauge cock and pulsation dampener shall be furnished for installation adjacent to pressure switches.

#### 2.13.3 Air Receivers

Receivers shall be designed for 200 psi working pressure. Receivers shall be factory air tested to 1-1/2 times the working pressure. Receivers shall be equipped with safety relief valves and accessories, including pressure gauges and automatic and manual drains. The outside of air receivers may be galvanized or supplied with commercial enamel finish. Receivers shall be designed and constructed in accordance with ASME BPVC SEC VIII D1 and shall have the design working pressures specified herein. A display of the ASME seal on the receiver or a certified test report from an approved independent testing laboratory indicating conformance to the ASME Code shall be provided.

#### 2.13.4 Intake Air Supply Filter

Dry type air filter shall be provided having a collection efficiency of 99 percent of particles larger than 10 microns. Filter body and media shall withstand a maximum 125 psi, capacity as indicated.

#### 2.13.5 Pressure Regulators

The air system shall be provided with the necessary regulator valves to maintain the desired pressure for the installed equipment. Regulators shall be designed for a maximum inlet pressure of 125 psi and a maximum temperature of 200 degrees F. Regulators shall be single-seated, pilot-operated with valve plug, bronze body and trim or equal, and threaded connections. The regulator valve shall include a pressure gauge and shall be provided with an adjustment screw for adjusting the pressure differential from 0 to 125 psi. Regulator shall be sized as indicated.

#### 2.14 PACKAGED BLOWER UNITS (OXYGENATING AIR COMPRESSORS)

Each packaged blower unit shall include a blower, motor, motor starter with controls, belt drive, inlet filter, pressure relief valve and silencing equipment factory mounted on a common base. The blowers and accessories shall receive a factory-applied enamel finish.

##### 2.14.1 Blowers

The blowers shall be of the straight, two lobe involute, rotary positive displacement design. The blower shall be designed to operate continuously without overheating or overloading the motor at any discharge pressure up

to and including relief valve set pressure of 14 PSIG. The blower package will be located at an elevation of 2800 feet above mean sea level (AMSL). Assume the room air temperature to be 85 degrees F for blower sizing purpose. The blower shall continuously delivers air at the capacity shown on the drawings. The blower case shall be of one-piece construction with separate headplates and shall be made of close-grained cast iron ribbed to prevent distortion under the specified operating conditions. The wide face spur gear shall be carbonized, ground and manufactured to AGMA standards and operate in an oil bath. Helical gears are not acceptable. Each impeller shaft assembly shall be supported by cylindrical roller bearings sized for long life. The drive and bearings shall be fixed auxiliary to control the axial location of the impeller assembly unit. A sealing arrangement shall be provided to prevent lubricant from contaminating the air stream. Each bearing shall be provided with a positive lip type oil seal designed to prevent lubricant from entering the air stream, and a very close tolerance on impeller shaft and headplates to reduce air leakage at the point where the shaft extends through the headplates and the blower casing. The bearing shall be splash lubricated at both ends of the shafts. The blower shall be shipped with openings sealed after injection of rust inhibiting powder and shall include copies of instruction manual and part list.

#### 2.14.2 Packaged Blower Accessories (Filter piping and Silencer, Etc.)

The inlet filter shall be the dry element type having a washable filter media. Efficiency shall be 90% or better for 10-micron material. The filter shall be sized to pass 100% of blower flow with the pressure drop not exceeding 3 inches W.C. for a clean filter. The inlet silencer shall be of the chamber-absorptive type. The silencer shall be sized for 100% of the blower flow with a pressure drop not to exceed 5.5 inches W.C. It shaft shall be welded steel construction. The discharge jet silencer shall be a chamber-absorptive silencer of welded steel construction and have an ASME code stamp (25 PSI G @500 degrees F.)

#### 2.14.3 Flexible Connections

Expansion joints or flexible connectors shall be provided at the inlet and discharge ends of the blower if recommended by blower manufacturer. A control joint shall be provided to limit the axial movement of discharge expansion joints

#### 2.14.4 Relief Valve

Relief valves shall be spring adjustable type sized to relieve the entire discharge flow without overload the blowers. The seat material shall be EPDM for high temperature operation. Each valve shall be set for 14 PSI, but shall be adjustable so that any setting from 10 to 15 PSI can be made (Adjust increments in one PSI)

#### 2.14.5 Drive System and Base

The belt drive system shall be capable of continuously transmitting the rated HP to the blower. It shall incorporate a belt drive, adjustable for belt tension, and include belts and belt guard. The blower manufacturer shall mount the drive motors and factory mount and align with the motor, drive blower before shipping. A factory fabricated base cast iron or welded steel construction shall be provided to mount and align the motor, drive blower and accessories

#### 2.15 DOMESTIC WATER SERVICE METER

Cold water meters 2 inches and smaller shall be positive displacement type conforming to AWWA C700. Cold water meters 2-1/2 inches and larger shall be turbine type conforming to AWWA C701. Meter register may be round or straight reading type. Meter shall be provided with a pulse generator, remote readout register and all necessary wiring and accessories.

### PART 3 EXECUTION

#### 3.1 GENERAL INSTALLATION REQUIREMENTS

Piping located in air plenums shall conform to NFPA 90A requirements. Plastic pipe shall not be installed in air plenums. Piping located in shafts that constitute air ducts or that enclose air ducts shall be noncombustible in accordance with NFPA 90A. Installation of plastic pipe where in compliance with NFPA may be installed in accordance with PPFA-01. The plumbing system shall be installed complete with necessary fixtures, fittings, traps, valves, and accessories. Water and drainage piping shall be extended 5 feet outside the building, unless otherwise indicated. A gate valve and drain shall be installed on the water service line inside the building approximately 6 inches above the floor from point of entry. Piping shall be connected to the exterior service lines or capped or plugged if the exterior service is not in place. Sewer and water pipes shall be laid in separate trenches, except when otherwise shown. Exterior underground utilities shall be at least 12 inches below the average local frost depth or as indicated on the drawings. If trenches are closed or the pipes are otherwise covered before being connected to the service lines, the location of the end of each plumbing utility shall be marked with a stake or other acceptable means. Valves shall be installed with control no lower than the valve body.

##### 3.1.1 Water Pipe, Fittings, and Connections

###### 3.1.1.1 Utilities

The piping shall be extended to fixtures, outlets, and equipment. The hot-water and cold-water piping system shall be arranged and installed to permit draining. The supply line to each item of equipment or fixture, except faucets, flush valves, or other control valves which are supplied with integral stops, shall be equipped with a shutoff valve to enable isolation of the item for repair and maintenance without interfering with operation of other equipment or fixtures. Supply piping to fixtures, faucets, hydrants, shower heads, and flushing devices shall be anchored to prevent movement.

###### 3.1.1.2 Cutting and Repairing

The work shall be carefully laid out in advance, and unnecessary cutting of construction shall be avoided. Damage to building, piping, wiring, or equipment as a result of cutting shall be repaired by mechanics skilled in the trade involved.

###### 3.1.1.3 Protection of Fixtures, Materials, and Equipment

Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the fixtures, materials, and equipment shall be thoroughly cleaned, adjusted, and operated. Safety guards shall be provided for exposed rotating

equipment.

#### 3.1.1.4 Mains, Branches, and Runouts

Piping shall be installed as indicated. Pipe shall be accurately cut and worked into place without springing or forcing. Structural portions of the building shall not be weakened. Aboveground piping shall run parallel with the lines of the building, unless otherwise indicated. Branch pipes from service lines may be taken from top, bottom, or side of main, using crossover fittings required by structural or installation conditions. Supply pipes, valves, and fittings shall be kept a sufficient distance from other work and other services to permit not less than 1/2 inch between finished covering on the different services. Bare and insulated water lines shall not bear directly against building structural elements so as to transmit sound to the structure or to prevent flexible movement of the lines. Water pipe shall not be buried in or under floors unless specifically indicated or approved. Changes in pipe sizes shall be made with reducing fittings. Use of bushings will not be permitted except for use in situations in which standard factory fabricated components are furnished to accommodate specific accepted installation practice. Change in direction shall be made with fittings, except that bending of pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than six diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be acceptable.

#### 3.1.1.5 Pipe Drains

Pipe drains indicated shall consist of 3/4 inch hose bibb with renewable seat and gate valve ahead of hose bibb. At other low points, 3/4 inch brass plugs or caps shall be provided. Disconnection of the supply piping at the fixture is an acceptable drain.

#### 3.1.1.6 Expansion and Contraction of Piping

Allowance shall be made throughout for expansion and contraction of water pipe. Each hot-water and hot-water circulation riser shall have expansion loops or other provisions such as offsets, changes in direction, etc., where indicated and/or required. Risers shall be securely anchored as required or where indicated to force expansion to loops. Branch connections from risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Horizontal runs of pipe over 50 feet in length shall be anchored to the wall or the supporting construction about midway on the run to force expansion, evenly divided, toward the ends. Sufficient flexibility shall be provided on branch runouts from mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining. If mechanical grooved pipe coupling systems are provided, the deviation from design requirements for expansion and contraction may be allowed pending approval of Contracting Officer.

#### 3.1.1.7 Not Used

#### 3.1.1.8 Commercial-Type Water Hammer Arresters

Commercial-type water hammer arresters shall be provided on hot- and cold-water supplies where indicated, with precise location and sizing to be in accordance with PDI WH 201. Water hammer arresters, where concealed,

shall be accessible by means of access doors or removable panels. Commercial-type water hammer arresters shall conform to PDI WH 201. Vertical capped pipe columns will not be permitted.

### 3.1.2 Compressed Air Piping (Non-Oil Free)

Compressed air piping shall be installed as specified for water piping and suitable for 125 psig working pressure. Compressed air piping shall have supply lines and discharge terminals legibly and permanently marked at both ends with the name of the system and the direction of flow.

### 3.1.3 Joints

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints shall be made up with fittings of compatible material and made for the specific purpose intended.

#### 3.1.3.1 Threaded

Threaded joints shall have American Standard taper pipe threads conforming to ASME B1.20.1. Only male pipe threads shall be coated with graphite or with an approved graphite compound, or with an inert filler and oil, or shall have a polytetrafluoroethylene tape applied.

#### 3.1.3.2 Not Used.

#### 3.1.3.3 Unions and Flanges

Unions, flanges and mechanical couplings shall not be concealed in walls, ceilings, or partitions. Unions shall be used on pipe sizes 2-1/2 inches and smaller; flanges shall be used on pipe sizes 3 inches and larger.

#### 3.1.3.4 Not Used.

#### 3.1.3.5 Cast Iron Soil, Waste and Vent Pipe

Bell and spigot compression and hubless gasketed clamp joints for soil, waste and vent piping shall be installed per the manufacturer's recommendations.

#### 3.1.3.6 Copper Tube and Pipe

The tube or fittings shall not be annealed when making connections.

- a. Brazed. Brazed joints shall be made in conformance with AWS B2.2, MSS SP-73, and CDA Tube A 4015 with flux and are acceptable for all pipe sizes. Copper to copper joints shall include the use of copper-phosphorus or copper-phosphorus-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-phosphorus, copper-phosphorus-silver or a silver brazing filler metal.
- b. Soldered. Soldered joints shall be made with flux and are only acceptable for piping 2 inches and smaller. Soldered joints shall conform to ASME B31.5 and CDA Tube A 4015. Soldered joints shall not be used in compressed air piping between the air

compressor and the receiver.

- c. Copper Tube Extracted Joint. An extracted mechanical joint may be made in copper tube. Joint shall be produced with an appropriate tool by drilling a pilot hole and drawing out the tube surface to form a collar having a minimum height of three times the thickness of the tube wall. To prevent the branch tube from being inserted beyond the depth of the extracted joint, dimpled depth stops shall be provided. Branch tube shall be notched for proper penetration into fitting to assure a free flow joint. Extracted joints shall be brazed in accordance with NAPHCC Plumbing Code using B-cup series filler metal in accordance with MSS SP-73. Soldered extracted joints will not be permitted.

#### 3.1.3.7 Plastic Pipe

Acrylonitrile-Butadiene-Styrene (ABS) pipe shall have joints made with solvent cement. PVC and CPVC pipe shall have joints made with solvent cement elastomeric, threading, (threading of Schedule 80 Pipe is allowed only where required for disconnection and inspection; threading of Schedule 40 Pipe is not allowed), or mated flanged.

#### 3.1.3.8 Glass Pipe

Joints for corrosive waste glass pipe and fittings shall be made with corrosion-resisting steel compression-type couplings with acrylonitrile rubber gaskets lined with polytetrafluoroethylene.

#### 3.1.3.9 Corrosive Waste Plastic Pipe

Joints for polyolefin pipe and fittings shall be made by mechanical joint or electrical fusion coil method in accordance with ASTM D 2657 and ASTM F 1290. Joints for filament-wound reinforced thermosetting resin pipe shall be made in accordance with manufacturer's instructions. Unions or flanges shall be used where required for disconnection and inspection.

#### 3.1.3.10 Other Joint Methods

#### 3.1.4 Dissimilar Pipe Materials

Connections between ferrous and non-ferrous copper water pipe shall be made with dielectric unions or flange waterways. Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping. Waterways shall have metal connections on both ends suited to match connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric waterways. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

#### 3.1.5 Corrosion Protection for Buried Pipe and Fittings

##### 3.1.5.1 Not Used

##### 3.1.5.2 Steel

Steel pipe, joints, and fittings shall be cleaned, coated with primer, and wrapped with tape. Pipe shall be cleaned, coated, and wrapped prior to

pipe tightness testing. Joints and fittings shall be cleaned, coated, and wrapped after pipe tightness testing. Tape shall conform to AWWA C203 and shall be applied with a 50 percent overlap. Primer shall be as recommended by the tape manufacturer.

### 3.1.6 Pipe Sleeves and Flashing

Pipe sleeves shall be furnished and set in their proper and permanent location.

#### 3.1.6.1 Sleeve Requirements

Pipes passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves are not required for supply, drainage, waste and vent pipe passing through concrete slab on grade, except where penetrating a membrane waterproof floor. A modular mechanical type sealing assembly may be installed in lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve using galvanized steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved. Sleeves shall not be installed in structural members, except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective floor, or roof, and shall be cut flush with each surface, except for special circumstances. Pipe sleeves passing through floors in wet areas such as mechanical equipment rooms, lavatories, kitchens, and other plumbing fixture areas shall extend a minimum of 4 inches above the finished floor. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4 inch clearance between bare pipe or insulation and inside of sleeve or between insulation and inside of sleeve. Sleeves in bearing walls and concrete slab on grade floors shall be steel pipe or cast-iron pipe. Sleeves in nonbearing walls or ceilings may be steel pipe, cast-iron pipe, galvanized sheet metal with lock-type longitudinal seam, or plastic. Except as otherwise specified, the annular space between pipe and sleeve, or between jacket over insulation and sleeve, shall be sealed as indicated with sealants conforming to ASTM C 920 and with a primer, backstop material and surface preparation as specified in Section 07900A JOINT SEALING. The annular space between pipe and sleeve, between bare insulation and sleeve or between jacket over insulation and sleeve shall not be sealed for interior walls which are not designated as fire rated. Sleeves through below-grade walls in contact with earth shall be recessed 1/2 inch from wall surfaces on both sides. Annular space between pipe and sleeve shall be filled with backing material and sealants in the joint between the pipe and wall as specified above. Sealant selected for the earth side of the wall shall be compatible with dampproofing/waterproofing materials that are to be applied over the joint sealant. Pipe sleeves in fire-rated walls shall conform to the requirements in Section 07840A FIRESTOPPING.

#### 3.1.6.2 Flashing Requirements

Pipes passing through roof shall be installed through a 16 ounce copper

flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 8 inches from the pipe and shall be set over the roof or floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 10 inches. For cleanouts, the flashing shall be turned down into the hub and caulked after placing the ferrule. Pipes passing through pitched roofs shall be flashed, using lead or copper flashing, with an adjustable integral flange of adequate size to extend not less than 8 inches from the pipe in all directions and lapped into the roofing to provide a watertight seal. The annular space between the flashing and the bare pipe or between the flashing and the metal-jacket-covered insulation shall be sealed as indicated. Flashing for dry vents shall be turned down into the pipe to form a waterproof joint. Pipes, up to and including 10 inches in diameter, passing through roof or floor waterproofing membrane may be installed through a cast-iron sleeve with caulking recess, anchor lugs, flashing-clamp device, and pressure ring with brass bolts. Flashing shield shall be fitted into the sleeve clamping device. Pipes passing through wall waterproofing membrane shall be sleeved as described above. A waterproofing clamping flange shall be installed.

#### 3.1.6.3 Waterproofing

Waterproofing at floor-mounted water closets shall be accomplished by forming a flashing guard from soft-tempered sheet copper. The center of the sheet shall be perforated and turned down approximately 1-1/2 inches to fit between the outside diameter of the drainpipe and the inside diameter of the cast-iron or steel pipe sleeve. The turned-down portion of the flashing guard shall be embedded in sealant to a depth of approximately 1-1/2 inches; then the sealant shall be finished off flush to floor level between the flashing guard and drainpipe. The flashing guard of sheet copper shall extend not less than 8 inches from the drainpipe and shall be lapped between the floor membrane in a solid coating of bituminous cement. If cast-iron water closet floor flanges are used, the space between the pipe sleeve and drainpipe shall be sealed with sealant and the flashing guard shall be upturned approximately 1-1/2 inches to fit the outside diameter of the drainpipe and the inside diameter of the water closet floor flange. The upturned portion of the sheet fitted into the floor flange shall be sealed.

#### 3.1.6.4 Optional Counterflashing

Instead of turning the flashing down into a dry vent pipe, or caulking and sealing the annular space between the pipe and flashing or metal-jacket-covered insulation and flashing, counterflashing may be accomplished by utilizing the following:

- a. A standard roof coupling for threaded pipe up to 6 inches in diameter.
- b. A tack-welded or banded-metal rain shield around the pipe.

#### 3.1.6.5 Pipe Penetrations of Slab on Grade Floors

Where pipes, fixture drains, floor drains, cleanouts or similar items penetrate slab on grade floors, except at penetrations of floors with waterproofing membrane as specified in paragraphs Flashing Requirements and Waterproofing, a groove 1/4 to 1/2 inch wide by 1/4 to 3/8 inch deep shall be formed around the pipe, fitting or drain. The groove shall be filled with a sealant as specified in Section 07900A JOINT SEALING.

### 3.1.7 Fire Seal

Where pipes pass through fire walls, fire-partitions, fire-rated pipe chase walls or floors above grade, a fire seal shall be provided as specified in Section 07840A FIRESTOPPING.

### 3.1.8 Supports

#### 3.1.8.1 General

Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers. In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run. Threaded sections of rods shall not be formed or bent.

#### 3.1.8.2 Not Used

#### 3.1.8.3 Pipe Hangers, Inserts, and Supports

Installation of pipe hangers, inserts and supports shall conform to MSS SP-58 and MSS SP-69, except as modified herein.

- a. Types 5, 12, and 26 shall not be used.
- b. Type 3 shall not be used on insulated pipe.
- c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for type 18 inserts.
- d. Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and shall have both locknuts and retaining devices furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.
- e. Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.
- f. Type 24 may be used only on trapeze hanger systems or on fabricated frames.
- g. Type 39 saddles shall be used on insulated pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher. Type 39 saddles shall be welded to the pipe.
- h. Type 40 shields shall:
  - (1) Be used on insulated pipe less than 4 inches.
  - (2) Be used on insulated pipe 4 inches and larger when the

temperature of the medium is 60 degrees F or less.

(3) Have a high density insert for all pipe sizes. High density inserts shall have a density of 8 pcf or greater.

- i. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves. Operating temperatures in determining hanger spacing for PVC or CPVC pipe shall be 120 degrees F for PVC and 180 degrees F for CPVC. Horizontal pipe runs shall include allowances for expansion and contraction.
- j. Vertical pipe shall be supported at each floor, except at slab-on-grade, at intervals of not more than 15 feet nor more than 8 feet from end of risers, and at vent terminations. Vertical pipe risers shall include allowances for expansion and contraction.
- k. Type 35 guides using steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided to allow longitudinal pipe movement. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered. Lateral restraints shall be provided as needed. Where steel slides do not require provisions for lateral restraint the following may be used:
  - (1) On pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher, a Type 39 saddle, welded to the pipe, may freely rest on a steel plate.
  - (2) On pipe less than 4 inches a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.
  - (3) On pipe 4 inches and larger carrying medium less than 60 degrees F a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.
- l. Pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation. The insulation shall be continuous through the hanger on all pipe sizes and applications.
- m. Where there are high system temperatures and welding to piping is not desirable, the type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 4 inches or by an amount adequate for the insulation, whichever is greater.
- n. Hangers and supports for plastic pipe shall not compress, distort, cut or abrade the piping, and shall allow free movement of pipe except where otherwise required in the control of expansion/contraction.

### 3.1.9 Welded Installation

Plumbing pipe weldments shall be as indicated. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe

to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either welding tees or forged branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Beveling, alignment, heat treatment, and inspection of weld shall conform to ASME B31.1. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has been removed from its original package, it shall be protected or stored so that its characteristics or welding properties are not affected. Electrodes that have been wetted or that have lost any of their coating shall not be used.

### 3.1.10 Pipe Cleanouts

Pipe cleanouts shall be the same size as the pipe except that cleanout plugs larger than 4 inches will not be required. A cleanout installed in connection with cast-iron soil pipe shall consist of a long-sweep 1/4 bend or one or two 1/8 bends extended to the place shown. An extra-heavy cast-brass or cast-iron ferrule with countersunk cast-brass head screw plug shall be caulked into the hub of the fitting and shall be flush with the floor. Cleanouts in connection with other pipe, where indicated, shall be T-pattern, 90-degree branch drainage fittings with cast-brass screw plugs, except plastic plugs shall be installed in plastic pipe. Plugs shall be the same size as the pipe up to and including 4 inches. Cleanout tee branches with screw plug shall be installed at the foot of soil and waste stacks, at the foot of interior downspouts, on each connection to building storm drain where interior downspouts are indicated, and on each building drain outside the building. Cleanout tee branches may be omitted on stacks in single story buildings with slab-on-grade construction or where less than 18 inches of crawl space is provided under the floor. Cleanouts on pipe concealed in partitions shall be provided with chromium plated bronze, nickel bronze, nickel brass or stainless steel flush type access cover plates. Round access covers shall be provided and secured to plugs with securing screw. Square access covers may be provided with matching frames, anchoring lugs and cover screws. Cleanouts in finished walls shall have access covers and frames installed flush with the finished wall. Cleanouts installed in finished floors subject to foot traffic shall be provided with a chrome-plated cast brass, nickel brass, or nickel bronze cover secured to the plug or cover frame and set flush with the finished floor. Heads of fastening screws shall not project above the cover surface. Where cleanouts are provided with adjustable heads, the heads shall be cast iron.

## 3.2 WATER HEATERS

### 3.2.1 Relief Valves

No valves shall be installed between a relief valve and its water heater or storage tank. The P&T relief valve shall be installed where the valve actuator comes in contact with the hottest water in the heater. Whenever possible, the relief valve shall be installed directly in a tapping in the tank or heater; otherwise, the P&T valve shall be installed in the hot-water outlet piping. A vacuum relief valve shall be provided on the cold water supply line to the water heater and mounted above and within 6 inches above the top of the water heater.

### 3.2.2 Installation of Gas--Fired Water Heater

Installation shall conform to NFPA 54 for gas fired. Storage water heaters that are not equipped with integral heat traps and having vertical pipe

risers shall be installed with heat traps directly on both the inlet and outlet. Circulating systems need not have heat traps installed. An acceptable heat trap may be a piping arrangement such as elbows connected so that the inlet and outlet piping make vertically upward runs of not less than 24 inches just before turning downward or directly horizontal into the water heater's inlet and outlet fittings. Commercially available heat traps, specifically designed by the manufacturer for the purpose of effectively restricting the natural tendency of hot water to rise through vertical inlet and outlet piping during standby periods may also be approved.

### 3.2.3 Not Used

### 3.2.4 Heat Traps

Piping to and from each water heater shall be routed horizontally and downward a minimum of 2 feet before turning in an upward direction.

### 3.2.5 Connections to Water Heaters

Connections of metallic pipe to water heaters shall be made with dielectric unions or flanges.

### 3.2.6 Not Used

## 3.3 FIXTURES AND FIXTURE TRIMMINGS

Polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Angle stops, straight stops, stops integral with the faucets, or concealed type of lock-shield, and loose-key pattern stops for supplies with threaded, sweat or solvent weld inlets shall be furnished and installed with fixtures. Where connections between copper tubing and faucets are made by rubber compression fittings, a beading tool shall be used to mechanically deform the tubing above the compression fitting. Exposed traps and supply pipes for fixtures and equipment shall be connected to the rough piping systems at the wall, unless otherwise specified under the item. Floor and wall escutcheons shall be as specified. Drain lines and hot water lines of fixtures for handicapped personnel shall be insulated and do not require polished chrome finish. Plumbing fixtures and accessories shall be installed within the space shown.

### 3.3.1 Fixture Connections

Where space limitations prohibit standard fittings in conjunction with the cast-iron floor flange, special short-radius fittings shall be provided. Connections between earthenware fixtures and flanges on soil pipe shall be made gastight and watertight with a closet-setting compound or neoprene gasket and seal. Use of natural rubber gaskets or putty will not be permitted. Fixtures with outlet flanges shall be set the proper distance from floor or wall to make a first-class joint with the closet-setting compound or gasket and fixture used.

### 3.3.2 Flushometer Valves

Flushometer valves shall be secured to prevent movement by anchoring the long finished top spud connecting tube to wall adjacent to valve with approved metal bracket. Flushometer valves for water closets shall be installed 39 inches above the floor, except at water closets intended for use by the physically handicapped where flushometer valves shall be mounted

at approximately 30 inches above the floor and arranged to avoid interference with grab bars. In addition, for water closets intended for handicap use, the flush valve handle shall be installed on the wide side of the enclosure.

### 3.3.3 Height of Fixture Rims Above Floor

Lavatories shall be mounted with rim 31 inches above finished floor. Wall-hung drinking fountains and water coolers shall be installed with rim 42 inches above floor. Wall-hung service sinks shall be mounted with rim 28 inches above the floor. Installation of fixtures for use by the physically handicapped shall be in accordance with CABO A117.1.

### 3.3.4 Shower Bath Outfits

The area around the water supply piping to the mixing valves and behind the escutcheon plate shall be made watertight by caulking or gasketing.

### 3.3.5 Fixture Supports

Fixture supports for off-the-floor lavatories, urinals, water closets, and other fixtures of similar size, design, and use, shall be of the chair-carrier type. The carrier shall provide the necessary means of mounting the fixture, with a foot or feet to anchor the assembly to the floor slab. Adjustability shall be provided to locate the fixture at the desired height and in proper relation to the wall. Support plates, in lieu of chair carrier, shall be fastened to the wall structure only where it is not possible to anchor a floor-mounted chair carrier to the floor slab.

#### 3.3.5.1 Support for Solid Masonry Construction

Chair carrier shall be anchored to the floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be imbedded in the masonry wall.

#### 3.3.5.2 Support for Concrete-Masonry Wall Construction

Chair carrier shall be anchored to floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be fastened to the concrete wall using through bolts and a back-up plate.

#### 3.3.5.3 Support for Steel Stud Frame Partitions

Chair carrier shall be used. The anchor feet and tubular uprights shall be of the heavy duty design; and feet (bases) shall be steel and welded to a square or rectangular steel tube upright. Wall plates, in lieu of floor-anchored chair carriers, shall be used only if adjoining steel partition studs are suitably reinforced to support a wall plate bolted to these studs.

#### 3.3.5.4 Support for Wood Stud Construction

Where floor is a concrete slab, a floor-anchored chair carrier shall be used. Where entire construction is wood, wood crosspieces shall be installed. Fixture hanger plates, supports, brackets, or mounting lugs shall be fastened with not less than No. 10 wood screws, 1/4 inch thick minimum steel hanger, or toggle bolts with nut. The wood crosspieces shall extend the full width of the fixture and shall be securely supported.

### 3.3.5.5 Wall-Mounted Water Closet Gaskets

Where wall-mounted water closets are provided, reinforced wax, treated felt, or neoprene gaskets shall be provided. The type of gasket furnished shall be as recommended by the chair-carrier manufacturer.

### 3.3.6 Backflow Prevention Devices

Plumbing fixtures, equipment, and pipe connections shall not cross connect or interconnect between a potable water supply and any source of nonpotable water. Backflow preventers shall be installed where indicated and in accordance with ICC International Plumbing Code at all other locations necessary to preclude a cross-connect or interconnect between a potable water supply and any nonpotable substance. In addition backflow preventers shall be installed at all locations where the potable water outlet is below the flood level of the equipment, or where the potable water outlet will be located below the level of the nonpotable substance. Backflow preventers shall be located so that no part of the device will be submerged. Backflow preventers shall be of sufficient size to allow unrestricted flow of water to the equipment, and preclude the backflow of any nonpotable substance into the potable water system. Bypass piping shall not be provided around backflow preventers. Access shall be provided for maintenance and testing. Each device shall be a standard commercial unit.

### 3.3.7 Access Panels

Access panels shall be provided for concealed valves and controls, or any item requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced, maintained, or replaced. Access panels shall be as specified in Section 05500A MISCELLANEOUS METAL.

### 3.3.8 Sight Drains

Sight drains shall be installed so that the indirect waste will terminate 2 inches above the flood rim of the funnel to provide an acceptable air gap.

### 3.3.9 Traps

Each trap shall be placed as near the fixture as possible, and no fixture shall be double-trapped. Traps installed on cast-iron soil pipe shall be cast iron. Traps installed on steel pipe or copper tubing shall be recess-drainage pattern, or brass-tube type. Traps installed on plastic pipe may be plastic conforming to ASTM D 3311. Traps for acid-resisting waste shall be of the same material as the pipe.

### 3.3.10 Shower Pans

Before installing shower pan, subfloor shall be free of projections such as nail heads or rough edges of aggregate. Drain shall be a bolt-down, clamping-ring type with weepholes, installed so the lip of the subdrain is flush with subfloor.

#### 3.3.10.1 General

The floor of each individual shower, the shower-area portion of combination shower and drying room, and the entire shower and drying room where the two are not separated by curb or partition, shall be made watertight with a shower pan fabricated in place. The shower pan material shall be cut to

size and shape of the area indicated, in one piece to the maximum extent practicable, allowing a minimum of 6 inches for turnup on walls or partitions, and shall be folded over the curb with an approximate return of 1/4 of curb height. The upstands shall be placed behind any wall or partition finish. Subflooring shall be smooth and clean, with nailheads driven flush with surface, and shall be sloped to drain. Shower pans shall be clamped to drains with the drain clamping ring.

3.3.10.2 Not Used.

3.3.10.3 Nonplasticized Chlorinated Polyethylene Shower Pans

Corners of nonplasticized chlorinated polyethylene shower pans shall be folded against the upstand by making a pig-ear fold. Hot-air gun or heat lamp shall be used in making corner folds. Each pig-ear corner fold shall be nailed or stapled 1/2 inch from the upper edge to hold it in place. Nails shall be galvanized large-head roofing nails. On metal framing or studs, approved duct tape shall be used to secure pig-ear fold and membrane. Where no backing is provided between the studs, the membrane slack shall be taken up by pleating and stapling or nailing to studding 1/2 inch from upper edge. To adhere the membrane to vertical surfaces, the back of the membrane and the surface to which it will be applied shall be coated with adhesive that becomes dry to the touch in 5 to 10 minutes, after which the membrane shall be pressed into place. Surfaces to be solvent-welded shall be clean. Surfaces to be joined with xylene shall be initially sprayed and vigorously cleaned with a cotton cloth, followed by final coating of xylene and the joining of the surfaces by roller or equivalent means. If ambient or membrane temperatures are below 40 degrees F the membrane and the joint shall be heated prior to application of xylene. Heat may be applied with hot-air gun or heat lamp, taking precautions not to scorch the membrane. Adequate ventilation and wearing of gloves are required when working with xylene. Membrane shall be pressed into position on the drain body, and shall be cut and fit to match so that membrane can be properly clamped and an effective gasket-type seal provided. On wood subflooring, two layers of 15 pound dry felt shall be installed prior to installation of shower pan to ensure a smooth surface for installation.

3.3.10.4 Nonplasticized Polyvinyl Chloride (PVC) Shower Pans

Nonplasticized PVC shall be turned up behind walls or wall surfaces a distance of not less than 6 inches in room areas and 3 inches above curb level in curbed spaces with sufficient material to fold over and fasten to outside face of curb. Corners shall be pig-ear type and folded between pan and studs. Only top 1 inch of upstand shall be nailed to hold in place. Nails shall be galvanized large-head roofing type. Approved duct tape shall be used on metal framing or studs to secure pig-ear fold and membrane. Where no backing is provided between studs, the membrane slack shall be taken up by pleating and stapling or nailing to studding at top inch of upstand. To adhere the membrane to vertical surfaces, the back of the membrane and the surface to which it is to be applied shall be coated with adhesive that becomes dry to the touch in 5 to 10 minutes, after which the membrane shall be pressed into place. Trim for drain shall be exactly the size of drain opening. Bolt holes shall be pierced to accommodate bolts with a tight fit. Adhesive shall be used between pan and subdrain. Clamping ring shall be bolted firmly. A small amount of gravel or porous materials shall be placed at weepholes so that holes remain clear when setting bed is poured. Membrane shall be solvent welded with PVC solvent cement. Surfaces to be solvent welded shall be clean (free of grease and

grime). Sheets shall be laid on a flat surface with an overlap of about 2 inches. Top edge shall be folded back and surface primed with a PVC primer. PVC cement shall be applied and surfaces immediately placed together, while still wet. Joint shall be lightly rolled with a paint roller, then as the joint sets shall be rolled firmly but not so hard as to distort the material. In long lengths, about 2 or 3 feet at a time shall be welded. On wood subflooring, two layers of 15 pound felt shall be installed prior to installation of shower pan to ensure a smooth surface installation.

### 3.4 VIBRATION-ABSORBING FEATURES

Mechanical equipment, including compressors and pumps, shall be isolated from the building structure by approved vibration-absorbing features, unless otherwise shown. Each foundation shall include an adequate number of standard isolation units. Each unit shall consist of machine and floor or foundation fastening, together with intermediate isolation material, and shall be a standard product with printed load rating. Piping connected to mechanical equipment shall be provided with flexible connectors.

#### 3.4.1 Tank- or Skid-Mounted Compressors

Floor attachment shall be as recommended by compressor manufacturer.

#### 3.4.2 Foundation-Mounted Compressors

Foundation shall be as recommended by the compressor manufacturer, except the foundation shall weigh not less than three times the weight of the moving parts.

### 3.5 WATER METER REMOTE READOUT REGISTER

The remote readout register shall be mounted at the location indicated or as directed by the Contracting Officer.

### 3.6 IDENTIFICATION SYSTEMS

#### 3.6.1 Identification Tags

Identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and valve number shall be installed on valves, except those valves installed on supplies at plumbing fixtures. Tags shall be 1-3/8 inch minimum diameter, and marking shall be stamped or engraved. Indentations shall be black, for reading clarity. Tags shall be attached to valves with No. 12 AWG, copper wire, chrome-plated beaded chain, or plastic straps designed for that purpose.

#### 3.6.2 Pipe Color Code Marking

Color code marking of piping shall be as specified in Section 09900 PAINTS AND COATINGS.

#### 3.6.3 Color Coding Scheme for Locating Hidden Utility Components

Scheme shall be provided in buildings having suspended grid ceilings. The color coding scheme shall identify points of access for maintenance and operation of operable components which are not visible from the finished space and installed in the space directly above the suspended grid ceiling. The operable components shall include valves, dampers, switches, linkages

and thermostats. The color coding scheme shall consist of a color code board and colored metal disks. Each colored metal disk shall be approximately 3/8 inch in diameter and secured to removable ceiling panels with fasteners. The fasteners shall be inserted into the ceiling panels so that the fasteners will be concealed from view. The fasteners shall be manually removable without tools and shall not separate from the ceiling panels when panels are dropped from ceiling height. Installation of colored metal disks shall follow completion of the finished surface on which the disks are to be fastened. The color code board shall have the approximate dimensions of 3 foot width, 30 inches height, and 1/2 inch thickness. The board shall be made of wood fiberboard and framed under glass or 1/16 inch transparent plastic cover. Unless otherwise directed, the color code symbols shall be approximately 3/4 inch in diameter and the related lettering in 1/2 inch high capital letters. The color code board shall be mounted and located in the mechanical or equipment room.

### 3.7 ESCUTCHEONS

Escutcheons shall be provided at finished surfaces where bare or insulated piping, exposed to view, passes through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or setscrew.

### 3.8 PAINTING

Painting of pipes, hangers, supports, and other iron work, either in concealed spaces or exposed spaces, is specified in Section 09900 PAINTS AND COATINGS.

### 3.9 TESTS, FLUSHING AND DISINFECTION

#### 3.9.1 Plumbing System

The following tests shall be performed on the plumbing system in accordance with ICC International Plumbing Code.

- a. Drainage and Vent Systems Test. The final test shall include a smoke test.
- b. Building Sewers Tests.
- c. Water Supply Systems Tests.

#### 3.9.1.1 Test of Backflow Prevention Assemblies

Backflow prevention assembly shall be tested using gauges specifically designed for the testing of backflow prevention assemblies. Gauges shall be tested annually for accuracy in accordance with the University of Southern California's Foundation of Cross Connection Control and Hydraulic Research or the American Water Works Association Manual of Cross Connection (Manual M-14). Report form for each assembly shall include, as a minimum, the following:

Data on Device	Data on Testing Firm
Type of Assembly	Name
Manufacturer	Address

Model Number	Certified Tester
Serial Number	Certified Tester No.
Size	Date of Test
Location	
Test Pressure Readings	Serial Number and Test Data of
Gauges	

If the unit fails to meet specified requirements, the unit shall be repaired and retested.

#### 3.9.1.2 Shower Pans

After installation of the pan and finished floor, the drain shall be temporarily plugged below the weep holes. The floor area shall be flooded with water to a minimum depth of 1 inch for a period of 24 hours. Any drop in the water level during test, except for evaporation, will be reason for rejection, repair, and retest.

#### 3.9.1.3 Compressed Air Piping (Nonoil-Free)

Piping systems shall be filled with oil-free dry air or gaseous nitrogen to 150 psig and hold this pressure for 2 hours with no drop in pressure.

#### 3.9.2 Defective Work

If inspection or test shows defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated. Repairs to piping shall be made with new materials. Caulking of screwed joints or holes will not be acceptable.

#### 3.9.3 System Flushing

##### 3.9.3.1 During Flushing

Before operational tests or disinfection, potable water piping system shall be flushed with potable water. Sufficient water shall be used to produce a water velocity that is capable of entraining and removing debris in all portions of the piping system. This requires simultaneous operation of all fixtures on a common branch or main in order to produce a flushing velocity of approximately 4 fps through all portions of the piping system. In the event that this is impossible due to size of system, the Contracting Officer (or the designated representative) shall specify the number of fixtures to be operated during flushing. Contractor shall provide adequate personnel to monitor the flushing operation and to ensure that drain lines are unobstructed in order to prevent flooding of the facility. Contractor shall be responsible for any flood damage resulting from flushing of the system. Flushing shall be continued until entrained dirt and other foreign materials have been removed and until discharge water shows no discoloration.

##### 3.9.3.2 After Flushing

System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced. After flushing and cleaning, systems shall be prepared for testing by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building due to the Contractor's failure to properly clean the piping system shall be repaired by the Contractor. When the system flushing is complete, the hot-water system shall be adjusted for

uniform circulation. Flushing devices and automatic control systems shall be adjusted for proper operation. All faucets and drinking water fountains, to include any device considered as an end point device by NSF 61, Section 9, shall be flushed a minimum of 0.25 gallons per 24 hour period, ten times over a 14 day period.

#### 3.9.4 Operational Test

Upon completion of flushing and prior to disinfection procedures, the Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory functional and operational efficiency. Such operating tests shall cover a period of not less than 8 hours for each system and shall include the following information in a report with conclusion as to the adequacy of the system:

- a. Time, date, and duration of test.
- b. Water pressures at the most remote and the highest fixtures.
- c. Operation of each fixture and fixture trim.
- d. Operation of each valve, hydrant, and faucet.
- e. Pump suction and discharge pressures.
- f. Temperature of each domestic hot-water supply.
- g. Operation of each floor and roof drain by flooding with water.
- h. Operation of each vacuum breaker and backflow preventer.
- i. Complete operation of each water pressure booster system, including pump start pressure and stop pressure.
- j. Compressed air readings at each compressor and at each outlet. Each indicating instrument shall be read at 1/2 hour intervals. The report of the test shall be submitted in quadruplicate. The Contractor shall furnish instruments, equipment, and personnel required for the tests; the Government will furnish the necessary water and electricity.

#### 3.9.5 Disinfection

After operational tests are complete, the entire domestic hot- and cold-water distribution system shall be disinfected. System shall be flushed as specified, before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA M20. The chlorinating material shall be fed into the water piping system at a constant rate at a concentration of at least 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the main with a hypochlorinator, or liquid chlorine injected into the main through a solution-feed chlorinator and booster pump, shall be used. The chlorine residual shall be checked at intervals to ensure that the proper level is maintained. Chlorine application shall continue until the entire main is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system being disinfected shall be opened and closed several times during the contact period to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall

remain in the system. Water tanks shall be disinfected by the addition of chlorine directly to the filling water. Following a 6 hour period, no less than 50 ppm chlorine residual shall remain in the tank. If after the 24 hour and 6 hour holding periods, the residual solution contains less than 25 ppm and 50 ppm chlorine respectively, flush the piping and tank with potable water, and repeat the above procedures until the required residual chlorine levels are satisfied. The system including the tanks shall then be flushed with clean water until the residual chlorine level is reduced to less than one part per million. During the flushing period each valve and faucet shall be opened and closed several times. Samples of water in disinfected containers shall be obtained from several locations selected by the Contracting Officer. The samples of water shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA EWW. The testing method used shall be either the multiple-tube fermentation technique or the membrane-filter technique. Disinfection shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

### 3.9.6 Flushing of Potable Water System

As an option to the system flushing specified above, the potable water system shall be flushed and conditioned until the residual level of lead is less than that specified by the base industrial hygienist. The water supply to the building shall be tested separately to ensure that any lead contamination found during potable water system testing is due to work being performed inside the building.

### 3.10 PLUMBING FIXTURE SCHEDULE

#### P-1 WATER CLOSET:

Siphon-jet, elongated bowl, top supply spud, ASME A112.19.2M, wall mounted.

Flange shall be copper alloy, cast iron, or plastic.

Gasket shall be wax type.

Seat - IAPMO Z124.5, Type A, white plastic, elongated, open front.

Flushometer Valve - ASSE 1037, large diaphragm type with non-hold-open feature, backcheck angle control stop, and vacuum breaker. Minimum upper chamber inside diameter of not less than 2-5/8 inches at the point where the diaphragm is sealed between the upper and lower chambers. The maximum water use shall be 1.6 gallons per flush.

#### P-2 WATER CLOSET HANDICAPPED:

Height of top rim of bowl shall be in accordance with CABO A117.1; other features are the same as P-1.

#### P-3 URINAL:

Wall hanging, with integral trap and extended shields, ASME A112.19.2M siphon jet. Top supply connection, back outlet.

Flushometer Valve - Similar to Flushometer Valve for P-1. The maximum water use shall be 1 gallon per flush.

## P-4 BATHTUB W/SHOWERHEAD:

Straight front, recessed, 60 x 32 x 16 in, enameled cast iron, ASME A112.19.1M raised bottom including appendix plastic, IAPMO Z124.1 with high wall.

Drain Assembly - Plug, cup strainer, overflow assembly, washers, couplings, pop-up lever, trip lever, stopper, fittings, etc., shall be brass, cast copper alloy, or wrought copper alloy. See paragraph FIXTURES for optional plastic accessories.

Bath/Shower Faucet: Bath/showers shall include bathtub spout, shower head, valves, and diverters. A shower head mounting with ball joint shall be provided. Diverter shall be integral with single mixing valves or mounted hot and cold water valves. Tub spout shall be copper alloy.

Bath/Showers Faucets for Handicap Use: Bath/showers equipped for handicap use shall be provided with a hand-held shower head in accordance with ASSE 1014. The hand-held shower head with swivel fitting shall include an adjustable spray, 60 inch polished stainless steel hose with in-line vacuum breaker and 25 inch grab a bar with sliding spray holder that locks at any height to allow the use of the unit as either a hand-held spray or a fixed shower head.

## P-5 LAVATORY:

Manufacturer's standard sink depth, , countertop type. For sink materials and installation, see Section 06650A SOLID POLYMER FABRICATION..

Faucet - Faucets shall meet the requirements of NSF 61, Section 9. Faucets shall be combination type. Faucets shall have replaceable seats and washers. Valves and handles shall be copper alloy. Connection between valve and spout for center-set faucet shall be of rigid metal tubing. The flow shall be limited to 2.5 gpm at a flowing pressure of 80 psi.

Handles - Lever type. Cast, formed, or drop forged copper alloy.

Drain - Pop-up drain shall include stopper, lift rods, jam nut, washer, and tail piece. See paragraph FIXTURES for optional plastic accessories.

## P-6 WHEELCHAIR LAVATORY:

Sink shall be same as P-5, except faucet shall have wrist or elbow controls and gooseneck spout. The flow shall be limited to 2.5 gpm at a flowing water pressure of 80 psi.

Drain - Strainer shall be copper alloy or stainless steel.

## P-7 KITCHEN SINK:

Ledge back with holes for faucet and spout double bowl 32 x 21 inches. For sink materials and installation, see Section 06650A SOLID POLYMER FABRICATION.

Faucet and Spout - Faucets shall meet the requirements of NSF 61, Section 9. Cast or wrought copper alloy. Aerator shall have internal threads. The flow shall be limited to 2.5 gpm at a flowing water pressure of 80 psi.

Handle - Cast copper alloy, wrought copper alloy, or stainless steel.  
Single lever type.

Drain Assembly - Plug, cup strainer, crossbars, jam nuts, washers, couplings, stopper, etc., shall be copper alloy or stainless steel. One bowl shall be provided with food waste disposal (see fixture Number P-16) below.

P-8 SERVICE SINK (MOP BASIN):

Enameled cast iron ASME A112.19.1M, copper alloy or stainless steel ASME A112.19.3M corner, floor mounted 28 inches square, 6-3/4 inches deep.

Faucet and Spout - Cast or wrought copper alloy, with top or bottom brace, with backflow preventer. Faucets shall have replaceable seat and the washer shall rotate onto the seat. Handles shall be lever type. Strainers shall have internal threads.

Drain Assembly - Plug, cup strainer, crossbars, jam nuts, washers, couplings, stopper, etc., shall be copper alloy or stainless steel.

P-9 N/A

P-10 LABORATORY SINK:

Countertop 20 inches wide x 15 inches deep, epoxy-coated resin in accordance with Section 06650. Thickness of sinks shall be manufacturer's standard. Drain and trap shall be corrosion resisting stainless steel.

Faucet and Spout - Cast or wrought copper alloy, with top or bottom brace, with backflow preventer. Faucets shall have replaceable seat and the washer shall rotate onto the seat. Strainers shall have internal threads.

Handles - Cast copper alloy, wrought copper alloy, or stainless steel, lever type.

P-11 N/A

P-12 N/A

P-13 Shower: Shower heads, CID A-A-240 other than emergency showers, shall be nonadjustable spray type and shall include a non-removable, tamperproof device to limit water flow to 2.5 gpm when tested in accordance with ASME A112.18.1M.

Wall Mounted: Shower head shall be nonadjustable spray, stainless steel or chromium plated brass with ball joint. Handles shall be chrome-plated die cast zinc alloy. Control valves shall be copper alloy and have metal integral parts of copper alloy, nickel alloy, or stainless steel. Valves shall be pressure reducing mechanical mixing, single lever type. Shower head shall be vandalproof with integral back.

Emergency Showers: Head for Emergency and Emergency Eye and Face Wash. Shower control shall be 1 inch or 1-1/2 inch stay-open type control valve. Unit shall be corrosion-resisting steel and shall be pedestal mounted. Emergency showers shall comply with ANSI Z358.1.

P-15 ELECTRIC WATERS:

Drinking fountains shall meet the requirements of NSF 61, Section 9. Water cooler drinking fountains shall: be self contained, conform to ARI 1010, use one of the fluorocarbon gases conforming to ARI 700 and ASHRAE 34 which has an Ozone Depletion Potential of less than or equal to 0.05, have a capacity to deliver 8 gph of water at 50 degrees F with an inlet water temperature of 80 degrees F while residing in a room environment of 90 degrees F, and have self-closing valves. Self-closing valves shall have automatic stream regulators, have a flow control capability, have a push button actuation or have a cross-shaped index metal turn handle without a hood. Exposed surfaces of stainless steel shall have No. 4 general polish finish. Spouts shall provide a flow of water at least 4 inches high so as to allow the insertion of a cup or glass under the flow of water.

Surface Wall-Mounted - Surface wall-mounted units shall be 15 inches wide, 20 inches deep, and have a back height of 6 to 8 inches. The bowl shall be made of stainless steel. The unit shall have concealed fasteners and be for interior installation.

Handicapped - Handicapped units shall be surface wall-mounted. The dimensions shall be 15 inches wide, 20 inches deep, with a back height of 6 to 8 inches. The unit shall clear the floor or ground by at least 8 inches.

A clear knee space shall exist between the bottom of the bowl and the floor or ground of at least 27 inches and between the front edge of the bowl and the body of the unit of at least 8 inches. A 8 inch wide clear space shall exist on both sides of the unit. The spout height shall be no more than 36 inches above the floor or ground to the outlet. The spout shall be at the front of the unit and direct the water flow in a trajectory that is parallel or nearly parallel to the front of the unit. The bowl shall be 6-1/2 inches high, made of stainless steel and be for interior installation.

#### P-16 FOOD WASTE DISPOSER:

Food waste disposers shall be in accordance with UL 430. Food disposal shall be provided with 1/2 horsepower motor and stainless steel grinding mechanism. Food grinders shall be connected to a drain of not less than 1 1/2 inches in diameter. Provide polyethylene or polyester drain flow chamber. Equip motor with manual reset, thermal overload protection, and sound insulation.

### 3.11 POSTED INSTRUCTIONS

Framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the systems.

### 3.12 PERFORMANCE OF WATER HEATING EQUIPMENT

Standard rating condition terms are as follows:

EF = Energy factor, overall efficiency.

ET = Thermal efficiency with 70 degrees F delta T.

EC = Combustion efficiency, 100 percent - flue loss when smoke = 0 (trace is permitted).

SL = Standby loss in W/sq. ft. based on 80 degrees F delta T, or in percent per hour based on nominal 90 degrees F delta T.

HL = Heat loss of tank surface area.

V = Storage volume in liters

### 3.12.1 Storage Water Heaters

3.12.1.1 Not Used.

3.12.1.2 Gas

a. Storage capacity of 100 gallons or less, and input rating of 75,000 Btu/h or less: minimum EF shall be 0.62-0.0019V per 10 CFR 430.

b. Storage capacity of more than 100 gallons - or input rating more than 75,000 Btu/h: Et shall be 77 percent; maximum SL shall be  $1.3+38/V$ , per ANSI Z21.10.3.

3.12.1.3 Not Used.

3.12.2 Not Used.

3.12.3 Not Used.

3.12.4 Not Used.

## 3.13 TABLES

TABLE I  
PIPE AND FITTING MATERIALS FOR  
DRAINAGE, WASTE, AND VENT PIPING SYSTEMS

Item #	Pipe and Fitting Materials	SERVICE					
		A	B	C	D	E	F
1	Cast iron soil pipe and fittings, hub and spigot, ASTM A 74 with compression gaskets	X	X	X	X	X	
2	Cast iron soil pipe and fittings hubless, CISPI 301 and ASTM A 888		X	X	X	X	
3	Cast iron drainage fittings, threaded, ASME B16.12 for use with Item 10	X		X	X		
4	Cast iron screwed fittings (threaded) ASME B16.4 for use with Item 10				X	X	
5	Not Used.						
6	Not Used.						
7	Not Used.						
8	Not Used.						
9	Malleable-iron threaded fittings, galvanized ASME B16.3 for use with Item 10				X	X	
10	Steel pipe, seamless galvanized, ASTM A 53/A 53M, Type S, Grade B	X			X	X	
11	Seamless red brass pipe, ASTM B 43		X	X			
12	Bronzed flanged fittings, ASME B16.24 for use with Items 11 and 14				X	X	
13	Cast copper alloy solder joint pressure fittings, ASME B16.18 for use with Item 14				X	X	
14	Seamless copper pipe, ASTM B 42				X		
15	Cast bronze threaded fittings, ASME B16.15				X	X	
16	Copper drainage tube, (DWV), ASTM B 306	X*	X	X*	X	X	
17	Wrought copper and wrought alloy solder-joint drainage	X	X	X	X	X	

TABLE I  
PIPE AND FITTING MATERIALS FOR  
DRAINAGE, WASTE, AND VENT PIPING SYSTEMS

Item #	Pipe and Fitting Materials	SERVICE					
		A	B	C	D	E	F
	fittings. ASME B16.29						
18	Cast copper alloy solder joint drainage fittings, DWV, ASME B16.23	X	X	X	X	X	
19	Acrylonitrile-Butadiene-Styrene (ABS) plastic drain, waste, and vent pipe and fittings ASTM D 2661, ASTM F 628	X	X	X	X	X	X
20	Polyvinyl Chloride plastic drain, waste and vent pipe and fittings, ASTM D 2665, ASTM F 891, (Sch 40) ASTM F 1760	X	X	X	X	X	X
21	Process glass pipe and fittings, ASTM C 1053						X
22	High-silicon content cast iron pipe and fittings (hub and spigot, and mechanical joint), ASTM A 518/A 518M		X			X	X
23	Polypropylene (PP) waste pipe and fittings, ASTM D 4101						X
24	Filament-wound reinforced thermosetting resin (RTRP) pipe, ASTM D 2996						X

## SERVICE:

- A - Underground Building Soil, Waste and Storm Drain
- B - Aboveground Soil, Waste, Drain In Buildings
- C - Underground Vent
- D - Aboveground Vent
- E - Interior Rainwater Conductors Aboveground
- F - Corrosive Waste And Vent Above And Belowground
- \* - Hard Temper

TABLE II  
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

Item No.	Pipe and Fitting Materials	SERVICE			
		A	B	C	D
1	Malleable-iron threaded fittings, a. Galvanized, ASME B16.3 for use with Item 4a	X	X	X	X
	b. Same as "a" but not galvanized for use with Item 4b			X	
2	Not Used.				
3	Not Used.				
4	Steel pipe: a. Seamless, galvanized, ASTM A 53/A 53M, Type S, Grade B	X	X	X	X
	b. Seamless, black, ASTM A 53/A 53M, Type S, Grade B			X	
5	Seamless red brass pipe, ASTM B 43	X	X		X
6	Bronze flanged fittings, ASME B16.24 for use with Items 5 and 7	X	X		X
7	Seamless copper pipe, ASTM B 42	X	X		X
8	Seamless copper water tube, ASTM B 88, ASTM B 88M	X**	X**	X**	X****
9	Cast bronze threaded fittings, ASME B16.15 for use with Items 5 and 7	X	X		X
10	Wrought copper and bronze solder-joint pressure fittings, ASME B16.22 for use with Items 5 and 7	X	X	X	X
11	Cast copper alloy solder-joint pressure fittings, ASME B16.18 for use with Items 8 and 9	X	X	X	X
12	Bronze and sand castings grooved joint pressure fittings for non- ferrous pipe ASTM B 584, for use with Item 2	X	X	X	

TABLE II  
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

Item No.	Pipe and Fitting Materials	SERVICE			
		A	B	C	D
13	Not Used.				
14	Not Used.				
15	Not Used.				
16	Not Used.				
17	Not Used.				
18	Not Used.				
19	Not Used.				
20	Not Used.				
21	Not Used.				
22	Not Used.				
23	Not Used.				
24	Not Used.				
25	Not Used.				
26	Not Used.				
27	Not Used.				
28	Not Used.				
29	Not Used.				
30	Not Used.				
31	Not Used.				
32	Steel pipeline flanges, MSS SP-44	X	X		
33	Fittings: brass or bronze; ASME B16.15, and ASME B16.18 ASTM B 828	X	X		
34	Carbon steel pipe unions, socket-welding and threaded, MSS SP-83	X	X	X	
35	Malleable-iron threaded pipe unions ASME B16.39	X	X		
36	Nipples, pipe threaded ASTM A 733	X	X	X	
37	Not Used.				

A - Cold Water Aboveground

B - Hot Water 180 degrees F Maximum Aboveground

C - Compressed Air Lubricated

D - Cold Water Service Belowground

Indicated types are minimum wall thicknesses.

\*\* - Type L - Hard

\*\*\* - Type K - Hard temper with brazed joints only or type K-soft temper  
without joints in or under floors

\*\*\*\* - In or under slab floors only brazed joints

TABLE III  
STANDARD RATING CONDITIONS AND MINIMUM PERFORMANCE RATINGS FOR WATER HEATING  
EQUIPMENT

## A. STORAGE WATER HEATERS

FUEL	STORAGE CAPACITY GALLONS	INPUT RATING	TEST PROCEDURE	REQUIRED
Gas	100 min.	OR 75,000 Btu/h	ANSI Z21.10.3	ET = 77 percent; SL = 1.3+38/V max.

## TERMS:

EF = Energy factor, overall efficiency.  
 ET = Thermal efficiency with 70 degrees F delta T.  
 EC = Combustion efficiency, 100 percent - flue loss when smoke = 0  
 (trace is permitted).  
 SL = Standby loss in W/sq. ft. based on 80 degrees F delta T, or in  
 percent per hour based on nominal 90 degrees F delta T.  
 HL = Heat loss of tank surface area  
 V = Storage volume in gallons

-- End of Section --

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DIVISION 15 - MECHANICAL

SECTION 15556A

FORCED HOT WATER HEATING SYSTEMS USING WATER AND STEAM HEAT EXCHANGERS

02/02

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## SECTION 15556A

FORCED HOT WATER HEATING SYSTEMS USING WATER AND STEAM HEAT EXCHANGERS  
02/02

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designations only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 653/A 653M	(1999)a Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B 32	(1996) Solder Metal
ASTM B 813	(2000) Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube

## AMERICAN WELDING SOCIETY (AWS)

AWS A5.8	(1992) Filler Metals for Brazing and Braze Welding
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## ASME INTERNATIONAL (ASME)

ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS  
INDUSTRY (MSS)

MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(1996) Pipe Hangers and Supports - Selection and Application

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

## Heating System; G-D0

Detail drawings consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Drawings shall also contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances and equipment relationship to other parts of the work including clearances for maintenance and operation.

## SD-03 Product Data

## Spare Parts; G-A0

Spare parts data for each different item of material and equipment specified, after approval of the related submittals and not later than two months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

## Welding; G-A0

Six copies of qualified procedures and list of names and identification symbols of qualified welders and welding operators, prior to welding operations.

## Framed Instructions; G-A0

Proposed diagrams, instructions, and other sheets, prior to posting. The instructions shall show wiring and control diagrams and complete layout of the entire system. The instructions shall include, in typed form, condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation and procedures for safely starting and stopping the system.

## SD-06 Test Reports

## Testing and Cleaning; G-A0

Performance test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

## Water Treatment Testing; G-A0

The water quality test report shall identify the chemical composition of the heating water. The report shall include a comparison of the condition of the water with the chemical company's recommended conditions. Any required corrective action shall be documented within the report.

## SD-07 Certificates

#### Bolts; G-AO

Written certification that the bolts furnished comply with the requirements of this specification, provided by the bolt manufacturer. The certification shall include illustrations of product-required markings, the date of manufacture, and the number of each type of bolt to be furnished based on this certification.

#### SD-10 Operation and Maintenance Data

##### Heating System; G-AO

Six copies of operation and six copies of maintenance manuals for the equipment furnished. One complete set, prior to performance testing and the remainder upon acceptance. Operating manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operating manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, water treatment procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout and simplified wiring and control diagrams of the system as installed. Manuals shall be provided prior to the field training course.

### 1.3 QUALIFICATIONS

Procedures and welders shall be qualified in accordance with the code under which the welding is specified to be accomplished.

### 1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be stored with protection from the weather, excessive humidity and excessive temperature variation; and dirt, dust, or other contaminants.

### 1.5 FIELD MEASUREMENTS

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

## PART 2 PRODUCTS

### 2.1 GENERAL MATERIAL AND EQUIPMENT REQUIREMENTS

#### 2.1.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

#### 2.1.2 Nameplates

Each major item of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

### 2.1.3 Equipment Guards and Access

Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact shall be fully enclosed or guarded in accordance with OSHA requirements. High temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard shall be properly guarded or covered with insulation of a type specified. Catwalks, operating platforms, ladders, and guardrails shall be provided where shown and shall be constructed in accordance with Section 05500A MISCELLANEOUS METAL.

### 2.1.4 Asbestos Prohibition

Asbestos and asbestos-containing products shall not be used.

### 2.1.5 Electrical Work

Electrical motor driven equipment specified shall be provided complete with motors, motor starters, and controls. Electric equipment (including motor efficiencies), and wiring shall be in accordance with Section 16415A ELECTRICAL WORK, INTERIOR. Standard motors shall be used. Electrical characteristics shall be as specified or indicated. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary for the motor control specified. Each motor shall be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Manual or automatic control and protective or signal devices required for the operation specified, and any control wiring, conduit, and connection to power required for controls and devices but not shown shall be provided.

## 2.2 PIPING, TUBING, AND FITTINGS

### 2.2.1 General

Piping, tubing, fittings and valves shall be as specified in the following sections:

- a. Piping, tubing, fittings and valves on the hot (shell) side of the main heat exchangers (HX-1A and HX-1B) shall be as specified in Section 15569A WATER AND STEAM HEATING; OIL, GAS OR BOTH, UP TO 20 MBTUH..
- b. Piping, tubing, fittings and valves on the cold (tube) side of the main heat exchangers (HX-1A and HX-1B) shall be as specified in Section 15200A PIPELINES, LIQUID PROCESS PIPING.
- c. Piping, tubing, fittings and valves on both sides of the energy recovery (plate and frame) heat exchangers (ER-1A and ER-1B) shall be as specified in Section 15200A PIPELINES, LIQUID PROCESS PIPING

## 2.3 MATERIALS AND ACCESSORIES

### 2.3.1 Iron and Steel Sheets

#### 2.3.1.1 Galvanized Iron and Steel

Galvanized iron and steel shall conform to ASTM A 653/A 653M, with general requirements conforming to ASTM A 653/A 653M. Gauge numbers specified are Manufacturer's Standard Gauge.

#### 2.3.1.2 Uncoated (Black) Steel

Uncoated (black) steel shall conform to ASTM A 366/A 366M or ASTM A 569/A 569M, composition, condition, and finish best suited to the intended use. Gauge numbers specified refer to Manufacturer's Standard Gauge.

#### 2.3.2 Solder

Solder shall conform to ASTM B 32. Solder and flux shall be lead free. Solder flux shall be liquid or paste form, non-corrosive and conform to ASTM B 813.

#### 2.3.3 Solder, Silver

Silver solder shall conform to AWS A5.8.

#### 2.3.4 Thermometers

Mercury shall not be used in thermometers. Thermometers shall have brass, malleable iron, or aluminum alloy case and frame, clear protective face, permanently stabilized glass tube with indicating-fluid column, white face, black numbers, and a 9 inch scale, and thermometers shall have rigid stems with straight, angular, or inclined pattern.

#### 2.3.5 Gauges

Gauges shall conform to ASME B40.1.

#### 2.3.6 Gaskets for Flanges

Composition gaskets shall conform to ASME B16.21. Gaskets shall be nonasbestos compressed material in accordance with ASME B16.21, 1/16 inch thickness, full face or self-centering flat ring type. Gaskets shall contain aramid fibers bonded with styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR). NBR binder shall be used for hydrocarbon service. Gaskets shall be suitable for pressure and temperatures of piping system.

#### 2.3.7 Not Used.

#### 2.3.8 Not Used.

#### 2.3.9 Not Used.

#### 2.3.10 Not Used.

#### 2.3.11 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

#### 2.4 NOT USED.

#### 2.4.1 Not Used

#### 2.5 BAG FILTRATION SYSTEM

The bag filtration system for the high temperature side (ERW) of the plate and frame heat exchanger shall be as specified in Section 11393 BAG FILTRATION SYSTEM.

#### 2.5.1 Strainers

All strainers shall be as specified in Section 15569A WATER AND STEAM HEATING; OIL, GAS OR BOTH, UP TO 20 MBTUH.

#### 2.5.2 Not Used

2.6 NOT USED.

2.7 NOT USED.

2.8 NOT USED.

#### 2.9 HEAT EXCHANGERS

Heat exchangers shall be multiple pass shell and U-tube type for main process water heating and plate and frame type for energy recovery process water heating. Heat exchanger type shall be designed to provide heating when supplied at the temperatures indicated on the drawing schedules. Temperature and pressure for plate and frame heat exchanger shall not exceed 200 degrees F and 125 psig for low temperature hot water. Temperature and pressure for shell and U-tube exchangers shall not exceed 250 degrees F and 100 psig.. Exchangers shall be constructed in accordance with ASME BPVC SEC VIII D1 and certified with ASME stamp secured to unit. U-tube bundles shall be completely removable for cleaning and tube replacement and shall be free to expand with shell. Shells shall be of seamless steel pipe or welded steel construction and tubes shall be seamless stainless steel tubing. Tube connections to plates shall be leakproof. Saddles or cradles shall be provided to mount shell and U-tube exchangers.

#### Plate and Frame Heat Exchangers.

Plates shall be of AISI 316 stainless steel. Gaskets shall be one-piece molded EPDM that are replaceable without adhesives. Individual plates shall be removable without having to remove plates in front or behind that plate. Plates shall be designed to assure turbulent flow through all plate segments. Plates shall have a built-in self aligning system to accurately locate the plates in the frame assembly and prevent lateral movement while maintaining maximum gasket pressure. Water pressure drop through clean plate segments and headers shall not exceed 15 psig nor be less than 10 psig. Connectins larger than 3 inches shall be ASME 300 pound flanged. Frames shall be fabricated of carbon steel and finished with baked epoxy enamel. The frame shall use a welded assembly. The unit cover plates shall be of sufficient thickness for the design pressure and and code requirements and shall have no welded reinforcements or stiffeners. The frame assembly shall have a steel roller on movable cover for ease of movement without rigging or handling equipment. Compression bolts shall not require special tools and shall be arranged to permit pack tightening at fixed cover only. Bolts shall be provided with rolled threads to reduce galling and have minimum high width hexagonal nuts to adequately distribute the load, plus bearing boxes at all critical closing bolts. Each frame shall be of adequate size and strength to hold additional plates for future capacity expansion of 30% (per unit) while still maintaining adequate room

to perform maintenance.

2.10 NOT USED.

2.11 INSULATION

Shop and field applied insulation shall be as specified in Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.12 FACTORY PAINTED EXPOSED SPACE HEATING EQUIPMENT

Radiator and convector enclosures shall be coated with the manufacturer's standard rust inhibiting primer for painting in the field as specified in Section 09900 PAINTS COATINGS. All other exposed heating equipment shall be painted at the factory with the manufacturer's standard primer and enamel finish.

2.13 Not Used

2.14 NOT USED.

2.15 NOT USED.

2.16 NOT USED.

PART 3 EXECUTION

3.1 INSTALLATION

All work shall be installed as indicated and in accordance with the manufacturer's diagrams and recommendations.

3.2 COLOR CODE MARKING AND FIELD PAINTING

Color code marking, field painting of exposed pipe, and field painting of factory primed equipment shall be as specified in Section 09900 PAINTS AND COATINGS.

3.3 NOT USED.

3.4 NOT USED.

3.5 CONNECTIONS TO EQUIPMENT

Supply and return connections shall be provided by the Contractor unless otherwise indicated. Valves and traps shall be installed in accordance with the manufacturer's recommendations. Unless otherwise indicated, the size of the supply and return pipes to each piece of equipment shall be not smaller than the connections on the equipment. No bushed connections shall be permitted. Change in sizes shall be made with reducers or increasers only.

3.5.1 Low Temperature WaterConnections

Connections, unless otherwise indicated, shall be made with malleable iron unions for piping 2-1/2 inches or less in diameter and with flanges for pipe 3 inches or more in diameter.

3.6 NOT USED.

### 3.7 RISERS

The location of risers is approximate. Exact locations of the risers shall be as approved.

3.8 NOT USED.

3.9 NOT USED.

3.10 NOT USED.

3.11 NOT USED.

3.12 NOT USED.

3.13 NOT USED.

3.14 NOT USED.

### 3.15 INSULATION

Thickness of insulation materials for piping and equipment and application shall be in accordance with Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS.

### 3.16 TESTING AND CLEANING

#### 3.16.1 Pressure Testing

The Contractor shall notify the Contracting Officer 7 days before the tests are to be conducted. The tests shall be performed in the presence of the Contracting Officer. The Contractor shall furnish all instruments and personnel required for the tests. Electricity, steam, and water will be furnished by the Government. All test results shall be accepted before thermal insulation is installed. The entire low temperature heating system, including heat exchanger, radiators and fittings, shall be hydrostatically tested and proved tight under a pressure of 45 psig for a period of four hours.

3.16.2 Not Used.

#### 3.16.3 Cleaning

After the hydrostatic and backflow prevention tests have been made and prior to the operating tests, the heat exchanger and piping shall be thoroughly cleaned by filling the system with a solution of 1 pound of caustic soda or 1 pound of trisodium phosphate per 50 gallons of water. Observe the proper safety precautions in the handling and use of these chemicals. The water shall be heated to approximately 150 degrees F, and the solution circulated in the system for a period of 48 hours, then drained and the system thoroughly flushed out with fresh water. Equipment shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. The Contractor shall be responsible for disposal of the flushing water. The Contractor shall be responsible for maintaining the system in a clean condition until final acceptance. Bearings shall be lubricated with oil or grease as recommended by the manufacturer.

3.16.4 Not Used.

### 3.17 MANUFACTURER'S SERVICES

Services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment specified shall be provided. The representative shall supervise the installation, adjustment, and testing of the equipment.

### 3.18 FRAMED INSTRUCTIONS

Framed instructions containing wiring and control diagrams under glass or in laminated plastic shall be posted where directed. Condensed operating instructions, prepared in typed form, shall be framed as specified above and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the system.

### 3.19 FIELD TRAINING

A field training course shall be provided for designated operating and maintenance staff members. Training shall be provided for a total period of 8 hours of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the items contained in the approved operation and maintenance manuals.

-- End of Section --

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## DIVISION 15 - MECHANICAL

## SECTION 15569A

WATER AND STEAM HEATING; OIL, GAS OR BOTH; UP TO 20 MBTUH

05/02

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## SECTION 15569A

WATER AND STEAM HEATING; OIL, GAS OR BOTH; UP TO 20 MBTUH  
05/02

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

AMCA 801 (1992) Industrial Process/Power Generation Fans: Specification Guidelines

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.13 (1991; Z21.13a; Z21.13b) Gas-Fired Low-Pressure Steam and Hot Water Boilers

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 105/A 105M (2001) Carbon Steel Forgings for Piping Applications

ASTM A 167 (1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

ASTM A 193/A 193M (2001a) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service

ASTM A 234/A 234M (2000) Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service

ASTM A 366/A 366M (1997e1) Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality

ASTM A 515/A 515M (1989; R 1997) Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service

ASTM A 516/A 516M (1990; R 1996) Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service

ASTM A 53/A 53M (2001) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A 653/A 653M (2000) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated

	(Galvannealed) by the Hot-Dip Process
ASTM B 32	(1996) Solder Metal
ASTM B 62	(1993) Composition Bronze or Ounce Metal Castings
ASTM B 75	(1999) Seamless Copper Tube
ASTM B 813	(2000) Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
ASTM B 828	(2000) Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
ASTM B 88	(1999) Seamless Copper Water Tube
ASTM B 88M	(1999) Seamless Copper Water Tube (Metric)
ASTM D 596	(1991; R 1995) Reporting Results of Analysis of Water
ASTM F 872	(1984; R 1990) Filter Units, Air Conditioning: Viscous-Impingement Type, Cleanable
AMERICAN WATER WORKS ASSOCIATION(AWWA)	
AWWA C606	(1997) Grooved and Shouldered Joints
AMERICAN WELDING SOCIETY (AWS)	
AWS A5.8	(1992) Filler Metals for Brazing and Braze Welding
AWS B2.2	(1991) Brazing Procedure and Performance Qualification
ASME INTERNATIONAL (ASME)	
ASME B1.20.1	(1983; R 1992) Pipe Threads, General Purpose (Inch)
ASME B16.11	(1996) Forged Fittings, Socket-Welding and Threaded
ASME B16.15	(1985; R 1994) Cast Bronze Threaded Fittings Classes 125 and 250
ASME B16.18	(1984; R 1994) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(1995; B16.22a1998) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

ASME B16.26 (1988) Cast Copper Alloy Fittings for Flared Copper Tubes

ASME B16.3 (1998) Malleable Iron Threaded Fittings

ASME B16.34 (1997) Valves - Flanged, Threaded, and Welding End

ASME B16.39 (1998) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300

ASME B16.4 (1998) Gray Iron Threaded Fittings

ASME B16.5 (1996; B16.5a) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24

ASME B16.9 (1993) Factory-Made Wrought Steel Buttwelding Fittings

ASME B31.1 (1998) Power Piping

ASME B31.5 (1992; B31.5a1994) Refrigeration Piping

ASME B40.1 (1991) Gauges - Pressure Indicating Dial Type - Elastic Element

ASME BPVC SEC IV (1998) Boiler and Pressure Vessel Code; Section IV, Heating Boilers

ASME BPVC SEC IX (1998) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

ASME BPVC SEC VIII D1 (1998) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage

ASME CSD-1 (1998) Controls and Safety Devices for Automatically Fired Boilers

## COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA Tube Handbook (1995) Copper Tube Handbook

## HYDRONICS INSTITUTE DIVISION OF GAMA (HYI)

HYI-01 (1998) I=B=R Ratings for Boilers, Baseboard Radiation and Finned Tube (Commercial) Radiation \ \$17.00;new ed ea Jan\$ \ X

## MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-25 (1998) Standard Marking System for Valves, Fittings, Flanges and Unions

MSS SP-58 (1993) Pipe Hangers and Supports -

## Materials, Design and Manufacture

MSS SP-69	(1996) Pipe Hangers and Supports - Selection and Application
MSS SP-70	(1998) Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	(1997) Gray Iron Swing Check Valves, Flanges and Threaded Ends
MSS SP-72	(1999) Ball Valves with Flanged or Butt-Welding Ends for General Service
MSS SP-73	(1991; R 1996) Brazing Joints for Copper and Copper Alloy Pressure Fittings
MSS SP-78	(1998) Cast Iron Plug Valves, Flanged and Threaded Ends
MSS SP-80	(1997) Bronze Gate, Globe, Angle and Check Valves
MSS SP-85	(1994) Cast Iron Globe & Angle Valves, Flanged and Threaded Ends

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1997) Enclosures for Electrical Equipment (1000 Volts Maximum)
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## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 211	(2000) Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances
NFPA 54	(1999) National Fuel Gas Code
NFPA 85	(2001) Boiler and Combustion Systems Hazards Code

## UNDERWRITERS LABORATORIES (UL)

UL 795	(1999) Commercial-Industrial Gas Heating Equipment
UL Gas&Oil Dir	(1999) Gas and Oil Equipment Directory

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Heating System; G-DO  
Piping Installation; G-AO  
Installation;

Detail drawings consisting of equipment layout including installation details and electrical connection diagrams; combustion and safety control diagrams; ductwork layout showing the location of supports and hangers, typical hanger details, gauge reinforcement, reinforcement spacing rigidity classification, and static pressure and seal classifications; and piping layout showing the location of guides and anchors, the load imposed on each support or anchor (not required for radiant floor tubing), and typical support details. Drawings shall include any information required to demonstrate that the system has been coordinated and will properly function as a unit and shall show equipment relationship to other parts of the work, including clearances required for operation and maintenance.

#### SD-03 Product Data

Manufacturer's Catalog Data; G-DO

Manufacturer's catalog data shall be included with the detail drawings for the following items:

Boilers  
Fuel Burning Equipment  
Combustion Control Equipment  
Pumps  
Fittings and Accessories  
Water Treatment System

The data shall show model, size, options, etc., that are intended for consideration. Data submitted shall be adequate to demonstrate compliance with contract requirements.

Spare Parts Data;

Spare parts data for each different item of material and equipment, after approval of the detail drawings and no later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of the parts recommended by the manufacturer to be replaced after 1 and 3 years of service.

Water Treatment Plan; G-DO  
Boiler Water Treatment; G-DO

Six complete copies of the proposed water treatment plan. The plan shall include a layout, control scheme, a list of the existing water conditions including the items listed in paragraph BOILER WATER TREATMENT, a list of all chemicals, the proportion of chemicals to be added, the final treated water conditions, and a description of environmental concerns for handling the chemicals.

Heating System Tests; G-AO  
Fuel System Tests; G-DO

Proposed test procedures for the heating system tests and fuel system tests, at least 2 weeks prior to the start of related testing.

Welding; G-AO

A copy of qualified welding procedures, at least 2 weeks prior to the start of welding operations.

A list of names and identification symbols of qualified welders and welding operators, at least 2 weeks prior to the start of welding operations.

Qualification; G-AO

A statement from the firms proposed to prepare submittals and perform installation and testing, demonstrating successful completion of similar services of at least five projects of similar size or scope, at least 2 weeks prior to the submittal of any other item required by this section.

Field Instructions; G-AO

System layout diagrams that show the layout of equipment, piping, and ductwork and typed condensed operation manuals explaining preventative maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system, framed under glass or laminated plastic, at least 2 weeks prior to the start of related testing. After approval, these items shall be posted where directed.

Tests; G-AO

Proposed test schedules for the heating system and fuel system tests, at least 2 weeks prior to the start of related testing.

#### SD-06 Test Reports

Heating System Tests; G-DO

Fuel System Tests; G-DO

Test reports for the heating system tests and the fuel system test, upon completion of testing complete with results.

Water Treatment Tests; G-DO.

a. The water quality test report shall identify the chemical composition of the boiler water. The report shall include a comparison of the condition of the boiler water with the manufacturer's recommended conditions. Any required corrective action shall be documented within the report.

b. A test report shall identify the condition of the boiler at the completion of 1 year of service. The report shall include a comparison of the condition of the boiler with the manufacturer's recommended operating conditions.

#### SD-07 Certificates

**Bolts; G-AO.**

Written certification by the bolt manufacturer that the bolts furnished comply with the requirements of this specification. The certification shall include illustrations of product markings, the date of manufacture, and the number of each type of bolt to be furnished based on this certification.

**Continuous Emissions Monitoring; G-AO.**

Written certification by the boiler manufacturer that each boiler furnished complies with Federal, state, and local regulations for emissions. The certification shall also include a description of applicable emission regulations. If any boiler is exempt from the emission regulations, the certification shall indicate the reason for the exemption.

**SD-10 Operation and Maintenance Data****Heating System; G-DO.**

Six complete manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 2 weeks prior to field training. The manuals shall include the manufacturer's name, model number, parts list, simplified wiring and control diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization shall be capable of providing 4 hour onsite response to a service call on an emergency basis.

**Water Treatment System; G-DO.**

Six complete copies of operating and maintenance manuals for the step-by-step water treatment procedures, including procedures for testing the water quality.

**1.3 GENERAL REQUIREMENTS****1.3.1 Standard Products**

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

**1.3.2 Asbestos Prohibition**

Asbestos and asbestos-containing products shall not be used.

**1.3.3 Nameplates**

Each major component of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the equipment. Each pressure vessel shall have an approved ASME stamp.

#### 1.3.4 Equipment Guards

Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact shall be fully enclosed or guarded in accordance with OSHA requirements. High temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard shall be properly guarded or covered with insulation of a type specified. Any catwalks, operating platforms, ladders, and/or guardrails required for maintenance of the equipment and/or to meet safety requirements shall be provided and shall be constructed in accordance with Section 05500A MISCELLANEOUS METAL.

#### 1.3.5 Verification of Dimensions

The Contractor shall become familiar with details of the work, verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work or ordering any materials.

#### 1.3.6 Welding

Boilers and piping shall be welded and brazed in accordance with qualified procedures using performance-qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPVC SEC IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests, and the tests shall be performed at the work site if practical. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record. Welding and nondestructive testing procedures for piping are specified in Section 05093A WELDING PRESSURE PIPING.

#### 1.4 MANUFACTURER'S SERVICES

Services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment specified shall be provided. The representative shall supervise the installing, adjusting, and testing of the equipment.

#### 1.5 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be protected from the weather, humidity and temperature variations, dirt and dust, and other contaminants.

### PART 2 PRODUCTS

#### 2.1 BOILERS

Each boiler shall have the output capacity in British thermal units per hour (Btuh) as indicated when fired with the specified fuels. The boiler shall be furnished complete with the gas burning equipment, boiler fittings and trim, automatic controls, forced draft burners (for both the firetube boilers and the sectional cast iron boiler), electrical wiring, insulation, piping connections, and protective jacket. The boiler shall be completely assembled and tested at the manufacturer's plant. Boiler auxiliaries including fans, motors, drives, and similar equipment shall be provided with at least 10 percent excess capacity to allow for field variations in

settings and to compensate for any unforeseen increases in pressure losses in appurtenant piping and ductwork. However, the boiler safety devices shall not be sized for a 10 percent excess capacity. The boiler and its accessories shall be designed and installed to permit ready accessibility for operation, maintenance, and service. Boilers shall be designed, constructed, and equipped in accordance with ASME BPVC SEC IV. Boilers shall be of the firetube type for the water heating process and sectional cast iron type for building heating. All boilers shall be designed for water service as specified herein. The boiler capacity shall be based on the ratings shown in HYI-01 or as certified by the American Boiler Manufacturers Association, or American Gas Association.

#### 2.1.1 Firetube Boiler(B-2A & 2B) (For Hatchery Water Heating)

Boiler shall be self-contained, single-pass, packaged type, complete with all accessories, mounted on a structural steel base. When the boilers are operating at maximum output, boilers shall meet a combustion efficiency of 80% percent or better.

##### 2.1.1.1 Hot Water Heating Firetube Boilers

The hot water heating boiler shall be capable of operating at the specified maximum continuous capacity without damage or deterioration to the boiler, its setting, firing equipment, or auxiliaries. The rated capacity shall be the capacity at which the boiler will operate continuously while maintaining at least the specified minimum efficiency. The boiler design conditions shall be as follows:

- a. Boiler design pressure 100 psig.
- b. Operating pressure at boiler outlet 40 psig.
- c. Hot water temperature 200 degrees F.
- d. Temperature differential between boiler discharge and system return 50 degrees F.
- e. Water pressure drop 10 psig.
- f. Outdoor ambient air temperature 90 degrees F (max), -17 degrees F (min).
- g. Site elevation 2,797 feet.
- h. Maximum continuous output capacity (I-B-R) 5,000,000 Btuh.
- i. Rated capacity 5,000,000 Btuh.
- j. Maximum exhaust stack temperature 500 degrees F.
- k. Gas fired boilers with a capacity of greater than or equal to 300,000 Btuh shall have a thermal efficiency of at least 80 percent when fired at the maximum and minimum ratings allowed by the controls.
- l. Boiler shall include a five year non-prorated parts and labor warranty against thermal shock at the conditions stated in paragraphs (a) thru (k) above.

## 2.1.2 Not Used

## 2.1.3 Sectional Cast Iron Boiler (B-1) (For Building Heating)

Boiler shall be of the rectangular, sectional type, self-contained, packaged type, complete with accessories, mounted on a structural steel base. Cast iron sections shall be free of leaks under all operating conditions. Access shall be provided to permit cleaning of internal tube surfaces.

## 2.1.3.1 Sectional Cast Iron Hot Water Heating Boilers

The hot water heating boiler shall be capable of operating at the specified maximum continuous capacity without damage or deterioration to the boiler, its setting, firing equipment, or auxiliaries. The rated capacity shall be the capacity at which the boiler will operate continuously while maintaining at least the specified minimum efficiency. The boiler design conditions shall be as follows:

- a. Boiler design pressure 35 psig.
- b. Operating pressure at boiler outlet 30 psig.
- c. Hot water temperature 200 degrees F.
- d. Temperature differential between boiler discharge and system return 20 degrees F.
- e. Water pressure drop 10 psig.
- f. Outdoor ambient air temperature 90 degrees F (max), -17 degrees F (min).
- g. Site elevation 2797 feet.
- h. Maximum continuous output capacity (I-B-R) 450,000 Btuh.
- i. Rated capacity 450,000 Btuh.
- j. Maximum exhaust stack temperature 500 degrees F.
- k. Gas fired boilers with a capacity of greater than or equal to 300,000 Btuh shall have a thermal efficiency of at least 80 percent when fired at the maximum and minimum ratings allowed by the controls.
- l. Boiler shall include a five year non-prorated parts and labor warranty against thermal shock at the conditions stated in paragraphs (a) thru (k) above.

## 2.1.4 Not used

## 2.1.5 Not Used

## 2.2 FUEL BURNING EQUIPMENT

Boiler shall be designed to burn natural gas . Each boiler shall comply with Federal, state, and local emission regulations.

## 2.2.1 Burners

### 2.2.1.1 Gas Fired Burners and Controls

Burner for the building heating boiler (B-1) and for process water heating boilers (B-2A and B-2B) shall be forced draft type. Burners shall be UL approved for forced draft with all air necessary for combustion supplied by a blower where the operation is coordinated with the burner. Burner shall be provided complete with fuel supply system in conformance with the following safety codes or standards:

- a. Gas-fired units with inputs greater than 400,000 Btuh per combustion chamber shall conform to UL 795 and Gas fired units less than 12,500,000 Btuh input shall conform to ANSI Z21.13.

### 2.2.1.2 Not Used

### 2.2.1.3 Not Used

### 2.2.1.4 Not Used

## 2.2.2 Draft Fans

Fans conforming to AMCA 801 ,forced-draft type, shall be furnished as an integral part of boiler design. Fans shall be centrifugal with backward-curved blades or axial flow type. Each fan shall be sized for output volume and static pressure rating sufficient for pressure losses, excess air requirements at the burner, leakages, temperature, and elevation corrections for worst ambient conditions, all at full combustion to meet net-rated output at normal firing conditions, plus an overall excess air volume of 10 percent against a 20 percent static overpressure. Noise levels for fans shall not exceed 85 decibels in any octave band at a 3 foot station. Forced draft fan bearings shall be air cooled.

### 2.2.2.1 Draft Fan Control

Forced-draft centrifugal fans shall be constant volume type.

### 2.2.2.2 Draft Fan Drives

Fans shall be driven by electric motors. Electric motor shall be totally enclosed fan cooled. Motor starter shall be magnetic across-the-line type with general purpose enclosure.

### 2.2.3 Not Used

### 2.2.4 Not Used

## 2.3 COMBUSTION CONTROL EQUIPMENT

Combustion control equipment shall be provided as a system by a single manufacturer. Field installed automatic combustion control system shall be installed in accordance with the manufacturer's recommendations and under the direct supervision of a representative of the control manufacturer. The boiler water temperature shall be controlled by a water temperature controller. The equipment shall operate electrically. On multiple boiler installations, each boiler unit shall have a completely independent system of controls responding to the load and to a master controller.

## 2.3.1 Not Used

## 2.3.1.1 Not Used

## 2.3.1.2 Not Used

## 2.3.2 Electrical controls

Electrical control devices shall be rated at 24 volts and shall be connected as specified in Section 16415A ELECTRICAL WORK, INTERIOR.

## 2.3.3 Water Temperature Controller

The controller shall be of sturdy construction and shall be protected against dust and dampness. The thermostatic element shall be inserted in a separable socket installed in the upper part of the boiler near the water outlet or in the boiler return piping. Fixed position (on-off) controller shall operate on a 10 degree F differential over an adjustable temperature range of approximately 140 to 220 degrees F. The controller for the building heating boiler (B-1) shall be furnished with necessary equipment to automatically reset the supply water temperature based on the outside air temperature according to the control schedule as shown on sheet M6.01.. The outside air reset controller shall be operated in such a manner that the operating temperatures required by the boiler manufacturer are not compromised. Boilers for process water heating (B-2A and B-2B) are not required to have supply water temperature setback capability.

## 2.3.4 Not Used

## 2.3.5 Boiler Master Controller (for B-2A and B-2B)

A boiler master controller, sensitive to a temperature transmitter in the return water header for the boiler shall be furnished to provide anticipatory signals to all boiler controllers. Boiler controllers shall react to anticipatory signals from the plant master controller as necessary in response to the boiler temperature indication to maintain the preset temperature. An automatic-manual switch shall be provided to allow the sequence of boiler loading to be varied to distribute equal firing time on both boilers. The master controller shall load the boilers one at a time as the load increases.

## 2.3.6 Boiler Combustion Controls and Positioners

- a. Gas boiler units shall be provided with two position (on-off) combustion control.

## 2.3.7 Combustion Safety Controls and Equipment

Combustion safety controls and equipment shall be UL listed, microprocessor-based distributed process controller. The system shall include mounting hardware, wiring and cables, and associated equipment. The controller shall be mounted completely wired, programmed, debugged, and tested to perform all of its functions. The controller shall process the signals for complete control and monitoring of the boiler. This shall include maintaining boiler status, starting and stopping all control functions, sequencing control functions and signaling alarm conditions. The program shall be documented and include cross references in description of coils and contacts. Microprocessor shall be able to perform self diagnostics and contain a message center to provide operator with status

and failure mode information. Controllers for each boiler shall be mounted on the boiler supporting structure. Control systems and safety devices for automatically fired boilers shall conform to ASME CSD-1. Electrical combustion and safety controls shall be rated at 120 volts, single phase, 60 Hz and shall be connected as specified in Section 16415A ELECTRICAL WORK, INTERIOR. A 4 inch diameter alarm bell shall be provided and shall be located where indicated or directed. The alarm bell shall ring when the boiler is shut down by any safety control or interlock. Indicating lights shall be provided on the control panel. A red light shall indicate flame failure, and a green light shall indicate that the main fuel valve is open. The following shutdown conditions shall require a manual reset before the boiler can automatically recycle:

- a. Flame failure.
- b. Failure to establish pilot flame.
- c. Failure to establish main flame.
- d. Low-water cutoff.
- e. High temperature cutoff.

#### 2.3.7.1 Low-water Cutoff

Low water cutoff shall be electrically actuated probe type low-water cutoff. Float chamber shall be provided with a blow-down connection. Cutoff shall cause a safety shutdown and sound an alarm when the boiler water level drops below a safe minimum level. A safety shutdown due to low water shall require manual reset before operation can be resumed and shall prevent recycling of the burner. The cutoff shall be in strict accordance to the latest version of code, ASME CSD-1 Controls and Safety Devices for Automatically Fired Boilers.

- a. Feedwater Regulator with Low-Water Cutoff: Regulator shall be an approved design sized for the application. A regulator shall be provided for each boiler. The feeder shall be so arranged that water will be fed to the boiler automatically when the water level in the boiler drops below a preset point and will actuate the alarm bell when the water level reaches the low danger point. The boiler feeder shall be arranged so that the burner and forced-draft fan will stop whenever the water level drops below a preset danger point. The boiler feeder shall be constructed so that the feedwater valve and seat are isolated from the float chamber to prevent overheating of the feed water and precipitation of scale on either the valve or seat. Each float mechanism, valve, and seat shall be constructed of an approved, durable, corrosion-resistant steel alloy. Valve seats shall be removable and renewable. The regulator shall be equipped with a large, self-cleaning strainer. The drain valve on the regulator shall be the gate or other straight-through type.
- b. Not Used.

#### 2.3.7.2 Combustion Air Damper Interlock (B-2A and B-2B, only).

The boiler safety controls shall incorporate a damper end switch interlock connection on the combustion air damper such that the boiler draft fan cannot start unless damper end switch is contacted.

## 2.4 PUMPS

### 2.4.1 Not Used

### 2.4.2 Hot Water Pumps

Circulating pumps for hot water shall be electrically driven single-stage centrifugal type and have a capacity not less than indicated. Pumps shall be supported on a concrete foundation with a cast iron or structural steel base and shall be closed-coupled shaft. The pumps shall be horizontal split case or end suction type as indicated in the drawing equipment schedules. The pump shaft shall be constructed of corrosion-resistant alloy steel, sleeve bearings and glands of bronze designed to accommodate a mechanical seal, and the housing of close-grained cast iron. Pump seals shall be capable of withstanding 240 degrees F temperature without external cooling. The motor shall have sufficient power for the service required, shall be of a type approved by the manufacturer of the pump, shall be suitable for the available electric service, and shall conform to the requirements of paragraph ELECTRICAL EQUIPMENT. Each pump suction and discharge connection shall be provided with a pressure gauge as specified. The circulating pump discharge header shall be provided with a flow switch. Flow switch unit shall be a self-contained swinging vane type to indicate fluid flow. Switch shall be a SPDT with 120-volt, 15-ampere rating.

## 2.5 COLD WATER CONNECTIONS

Connections shall be provided which includes consecutively in line a strainer, backflow prevention device, and water pressure regulator in that order in the direction of the flow. The backflow prevention device shall be provided as indicated and in compliance with Section 15400A PLUMBING, GENERAL PURPOSE. Cold water fill connections shall be made to the water supply system as indicated. Necessary pipe, fittings, and valves required for water connections between the boiler and cold water main shall be provided as shown. The pressure regulating valve shall be of a type that will not stick or allow pressure to build up on the low side. The valve shall be set to maintain a terminal pressure of approximately, lately 5 psi in excess of the static head on the system and shall operate within a 2 psi tolerance regardless of cold water supply piping pressure and without objectionable noise under any condition of operation.

## 2.6 UNIT HEATERS

Heaters shall be as specified below, and shall have a heating capacity not in excess of 125 percent of the capacity indicated.

### 2.6.1 Propeller Fan Unit Heaters

Heaters shall be designed for suspension and arranged for vertical and horizontal discharge of air as indicated. Casings shall be not less than 20 gauge black steel and finished with lacquer or enamel. Suitable stationary deflectors shall be provided to assure proper air and heat penetration capacity at floor level based on established design temperature. Suspension from heating pipes will not be permitted. Fans for vertical discharge type heaters shall operate at speeds not in excess of 1,200 rpm, except that units with 80,000 Btu output capacity or less may operate at speeds up to 1,800 rpm. Horizontal discharge type unit heaters shall have discharge or face velocities not in excess of the following:

Unit Capacity, cfm	Face Velocity, fpm
Up to 1,000	800
1,001 to 3,000	900
3,001 and over	1,000

## 2.6.2 Not Used

## 2.6.3 Heating Elements

Heating coils shall be as specified in Section 15895A AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM for types indicated. Coils shall be suitable for use with water up to 250 degrees F.

## 2.6.4 Motors

Motors shall be provided with NEMA 250 general purpose enclosure. Motors and motor controls shall otherwise be as specified in Section 16415A ELECTRICAL WORK, INTERIOR.

## 2.6.5 Motor Switches

Motors shall be provided with manual selection switches with "Off," and "Automatic" positions and shall be equipped with thermal overload protection.

## 2.16.6 Controls

Controls shall be provided as shown on the drawings, sheet M6.04.

## 2.7 NOT USED

## 2.8 NOT USED

## 2.9 AIR HANDLING UNITS

Air handling units and associated equipment shall be in accordance with Section 15895A AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

## 2.10 FITTINGS AND ACCESSORIES

Boiler fittings and accessories shall be installed with each boiler in accordance with ASME BPVC SEC IV, unless otherwise specified.

## 2.10.1 NOT USED

## 2.10.2 NOT USED

## 2.10.3 NOT USED

## 2.10.4 Conventional Breeching and Stacks

## 2.10.4.1 Breeching

Each boiler shall be connected to the stack or flue by breeching constructed of black steel sheets not less than 0.0478 inch thick nor less

than thickness of stack, whichever is larger. Plastic materials polyetherimide (PEI) and polyethersulfone (PES) are forbidden to be used for vent piping of combustion gases. The clear distance between any portion of the breeching surface and any combustible material shall not be less than that specified in NFPA 211. Joints and seams shall be securely fastened and made airtight. Suitable hinged and gasketed cleanouts shall be provided, which will permit cleaning the entire smoke connection without dismantling. Flexible-type expansion joints shall be provided as required and shall not require packing.

#### 2.10.4.2 Stacks

Individual stub stacks shall extend above the roof to the heights indicated. Individual stub stacks shall extend above the roof to the height determined by NFPA 54 as determined by the roof slope, stack location and method of burner draft. Stack section shall be sheet steel having a thickness of not less than 0.0972 inch. Prefabricated double wall stacks system shall extend above the roof to the height designated by NFPA 54 as determined by the roof slope and stack location. The inner stack shall be 304 stainless steel having a thickness of not less than 0.035 inch. The outer stack shall be sheet steel having a thickness of not less than 0.025 inch. A method of maintaining concentricity between the inner and outer stacks shall be incorporated. The joints between the stack sections shall be sealed to prevent flue gas leakage. The stack shall incorporate an automatic damper, to be closed when the boiler is off and must be proved open before burner ignites. A 0.3125 inch diameter hole shall be provided in the stack not greater than 6 inches from the furnace flue outlet for sampling of the exit gases. A method shall be provided to seal the hole to prevent exhaust gases from entering the boiler room when samples are not being taken. Each stack shall be provided complete with rain hood. Plastic materials polyetherimide (PEI) and polyethersulfone (PES) are forbidden to be used for vent piping of combustion gases.

#### 2.10.5 Not Used.

#### 2.10.6 Expansion Tank

The hot water pressurization system shall include a diaphragm-type expansion tank which will accommodate the expanded water of the system generated within the normal operating temperature range, limiting the pressure increase at all components in the system to the maximum allowable pressure at those components. The only air in the system shall be the permanent sealed-in air cushion contained in the diaphragm-type tank. The sizes shall be as indicated. The expansion tank shall be welded steel, constructed, tested, and stamped in accordance with ASME BPVC SEC VIII D1 for a working pressure of 125 psi and precharged to the minimum operating pressure. The tank's air chamber shall be fitted with an air charging valve and pressure gauge. The tank shall be supported by steel legs or bases for vertical installation or steel saddles for horizontal installations. The tank shall have lifting rings and a drain connection. All components shall be suitable for a maximum operating temperature of 250 degrees F.

#### 2.10.7 Air Separator

External air separation tank shall be steel, constructed, tested and stamped in accordance with ASME BPVC SEC VIII D1 for a working pressure of 125 psi. The capacity of the air separation tank indicated is minimum.

#### 2.10.8 Filters

Filters shall conform to ASTM F 872.

#### 2.10.9 Not Used

#### 2.10.10 Steel Sheets

##### 2.10.10.1 Galvanized Steel

Galvanized steel shall be ASTM A 653/A 653M.

##### 2.10.10.2 Uncoated Steel

Uncoated steel shall be ASTM A 366/A 366M, composition, condition, and finish best suited to the intended use. Gauge numbers specified refer to manufacturer's standard gauge.

#### 2.10.11 Gaskets

Gaskets shall be nonasbestos material in accordance with ASME B16.21, full face or self-centering type. The gaskets shall be of the spiral wound type with graphite filler material.

#### 2.10.12 Steel Pipe and Fittings

##### 2.10.12.1 Steel Pipe

Steel pipe shall be ASTM A 53/A 53M, Type E or S, Grade A or B, black steel, standard weight.

##### 2.10.12.2 Steel Pipe Fittings

Fittings shall have the manufacturer's trademark affixed in accordance with MSS SP-25 so as to permanently identify the manufacturer.

##### 2.10.12.3 Steel Flanges

Flanged fittings including flanges, bolts, nuts, bolt patterns, etc. shall be in accordance with ASME B16.5 class 150 and shall have the manufacturers trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A 105/A 105M. Flanges for high temperature water systems shall be serrated or raised-face type. Blind flange material shall conform to ASTM A 516/A 516M cold service and ASTM A 515/A 515M for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A 193/A 193M.

##### 2.10.12.4 Welded Fittings

Welded fittings shall conform to ASTM A 234/A 234M with WPA marking. Buttwelded fittings shall conform to ASME B16.9, and socket-welded fittings shall conform to ASME B16.11.

##### 2.10.12.5 Cast-Iron Fittings

Fittings shall be ASME B16.4, Class 125, type required to match connecting piping.

##### 2.10.12.6 Malleable-Iron Fittings

Fittings shall be ASME B16.3, type as required to match connecting piping.

#### 2.10.12.7 Unions

Unions shall be ASME B16.39, Class 150.

#### 2.10.12.8 Threads

Pipe threads shall conform to ASME B1.20.1.

#### 2.10.12.9 Not Used.

#### 2.10.13 Copper Tubing and Fittings

##### 2.10.13.1 Copper Tubing

Tubing shall be ASTM B 88, ASTM B 88M, Type K or L. Adapters for copper tubing shall be brass or bronze for brazed fittings.

##### 2.10.13.2 Solder-Joint Pressure Fittings

Wrought copper and bronze solder-joint pressure fittings shall conform to ASME B16.22 and ASTM B 75. Cast copper alloy solder-joint pressure fittings shall conform to ASME B16.18 and ASTM B 828.

##### 2.10.13.3 Flared Fittings

Cast copper alloy fittings for flared copper tube shall conform to ASME B16.26 and ASTM B 62.

##### 2.10.13.4 Adapters

Adapters may be used for connecting tubing to flanges and to threaded ends of valves and equipment. Extracted brazed tee joints produced with an acceptable tool and installed as recommended by the manufacturer may be used.

##### 2.10.13.5 Threaded Fittings

Cast bronze threaded fittings shall conform to ASME B16.15.

##### 2.10.13.6 Brazing Material

Brazing material shall conform to AWS A5.8.

##### 2.10.13.7 Brazing Flux

Flux shall be in paste or liquid form appropriate for use with brazing material. Flux shall be as follows: lead-free; have a 100 percent flushable residue; contain slightly acidic reagents; contain potassium borides, and contain fluorides. Silver brazing materials shall be in accordance with AWS A5.8.

##### 2.10.13.8 Solder Material

Solder metal shall conform to ASTM B 32 95-5 tin-antimony.

##### 2.10.13.9 Solder Flux

Flux shall be either liquid or paste form, non-corrosive and conform to ASTM B 813.

2.10.13.10 Not Used.

#### 2.10.14 Dielectric Waterways and Flanges

Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping. Waterways shall have metal connections on both ends suited to match connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric waterways.

#### 2.10.15 Flexible Pipe Connectors

Flexible pipe connectors shall be designed for 125 psi or 150 psi service. Connectors shall be installed where indicated. The flexible section shall be constructed of rubber, tetrafluoroethylene resin, or corrosion-resisting steel, bronze, monel, or galvanized steel. Materials used and the configuration shall be suitable for the pressure, vacuum, and temperature medium. The flexible section shall be suitable for service intended and may have threaded, welded, soldered, flanged, or socket ends. Flanged assemblies shall be equipped with limit bolts to restrict maximum travel to the manufacturer's standard limits. Unless otherwise indicated, the length of the flexible connectors shall be as recommended by the manufacturer for the service intended. Internal sleeves or liners, compatible with circulating medium, shall be provided when recommended by the manufacturer. Covers to protect the bellows shall be provided where indicated.

#### 2.10.16 Pipe Supports

Pipe supports shall conform to MSS SP-58 and MSS SP-69.

#### 2.10.17 Pipe Expansion

##### 2.10.17.1 Expansion Loops

Expansion loops and offsets shall provide adequate expansion of the main straight runs of the system within the stress limits specified in ASME B31.1.

The loops and offsets shall be cold-sprung. Pipe guides and anchors shall be provided as necessary to control direction of expansion.

#### 2.10.18 Valves

Valves shall be Class 125 and shall be suitable for the application. Grooved ends per AWWA C606 may be used for water service only. Valves in nonboiler external piping shall meet the material, fabrication and operating requirements of ASME B31.1. The connection type of all valves shall match the same type of connection required for the piping on which installed.

##### 2.10.18.1 Gate Valves

Gate valves 2-1/2 inches and smaller shall conform to MSS SP-80 bronze rising stem, threaded, solder, or flanged ends. Gate valves 3 inches and larger shall conform to MSS SP-70 cast iron bronze trim, outside screw and

yoke, flanged, or threaded ends.

#### 2.10.18.2 Globe Valves

Globe valves 2-1/2 inches and smaller shall conform to MSS SP-80, bronze, threaded, soldered, or flanged ends. Globe valves 3 inches and larger shall conform to MSS SP-85, cast iron, bronze trim, flanged, or threaded ends.

#### 2.10.18.3 Check Valves

Check valves shall be center-guided, disc type, spring loaded. Check valves 2-1/2 inches and smaller shall conform to MSS SP-80, bronze, threaded, soldered, or flanged ends. Check valves 3 inches and larger shall conform to MSS SP-71, cast iron, bronze trim, flanged, or threaded ends.

#### 2.10.18.4 Angle Valves

Angle valves 2-1/2 inches and smaller shall conform to MSS SP-80 bronze, threaded, soldered, or flanged ends. Angle valves 3 inches and larger shall conform to MSS SP-85, cast iron, bronze trim, flanged, or threaded ends.

#### 2.10.18.5 Ball Valves

Ball valves 1/2 inch and larger shall conform to MSS SP-72, ductile iron or bronze, threaded, soldered, or flanged ends.

#### 2.10.18.6 Plug Valves

Plug valves 2 in. and larger shall conform to MSS SP-78. Plug valves smaller than 2 in. shall conform to ASME B16.34.

#### 2.10.18.7 Not Used.

#### 2.10.18.8 Balancing Valves

Balancing valves shall have meter connections with positive shutoff valves. An integral pointer shall register the degree of valve opening. Valves shall be calibrated so that flow rate can be determined when valve opening in degrees and pressure differential across valve is known. Each balancing valve shall be constructed with internal seals to prevent leakage and shall be supplied with preformed insulation. Valves shall be suitable for 250 degrees F temperature and working pressure of the pipe in which installed. Valve bodies shall be provided with tapped openings and pipe extensions with shutoff valves outside of pipe insulation. The pipe extensions shall be provided with quick connecting hose fittings for a portable meter to measure the pressure differential. One portable differential meter shall be furnished. The meter suitable for the operating pressure specified shall be complete with hoses, vent, and shutoff valves, and carrying case. In lieu of the balancing valve with integral metering connections, a ball valve or plug valve with a separately installed orifice plate or venturi tube may be used for balancing.

#### 2.10.18.9 Automatic Flow Control Valves

In lieu of the specified balancing valves, automatic flow control valves may be provided to maintain constant flow and shall be designed to be

sensitive to pressure differential across the valve to provide the required opening. Valves shall be selected for the flow required and provided with a permanent nameplate or tag carrying a permanent record of the factory-determined flow rate and flow control pressure levels. Valves shall control the flow within 5 percent of the tag rating. Valves shall be suitable for the maximum operating pressure of 125 psi or 150 percent of the system operating pressure, whichever is greater. Where the available system pressure is not adequate to provide the minimum pressure differential that still allows flow control, the system pump head capability shall be increased. Valves shall be suitable for 250 degrees F temperature service. Valve materials shall be same as specified for the heating system check, globe, angle, and gate valves. Valve operator shall be the electric motor type or pneumatic type as applicable. Valve operator shall be capable of positive shutoff against the system pump head. Valve bodies shall be provided with tapped openings and pipe extensions with shutoff valves outside of pipe insulation. The pipe extensions shall be provided with quick connecting hose fittings for a portable meter to measure the pressure differential across the automatic flow control valve. A portable meter shall be provided with accessory kit as recommended for the project by the automatic valve manufacturer.

#### 2.10.18.10 Butterfly Valves

Butterfly valves shall be 2-flange type or lug wafer type, and shall be bubbletight at 150 psig. Valve bodies shall be cast iron, malleable iron, or steel. ASTM A 167, Type 404 or Type 316, corrosion resisting steel stems, bronze, or corrosion resisting steel discs, and synthetic rubber seats shall be provided. Valves smaller than 8 inches shall have throttling handles with a minimum of seven locking positions. Valves 8 inches and larger shall have totally enclosed manual gear operators with adjustable balance return stops and position indicators. Valves in insulated lines shall have extended neck to accommodate insulation thickness.

#### 2.10.18.11 Drain valves

Drain valves shall be provided at each drain point of blowdown as recommended by the boiler manufacturer. Piping shall conform to ASME BPVC SEC IV and ASTM A 53/A 53M.

#### 2.10.18.12 Safety Valves

Safety valves shall have steel bodies and shall be equipped with corrosion-resistant trim and valve seats. The valves shall be properly guided and shall be positive closing so that no leakage can occur. Adjustment of the desired back-pressure shall cover the range between 2 and 10 psig. The adjustment shall be made externally, and any shafts extending through the valve body shall be provided with adjustable stuffing boxes having renewable packing. Boiler safety valves of proper size and of the required number, in accordance with ASME BPVC SEC IV, shall be installed so that the discharge will be through piping extended to a location as indicated. Each discharge pipe for hot water service shall be pitched away from the valve seat.

#### 2.10.19 Strainers

Basket and "Y" type strainers shall be the same size as the pipelines in which they are installed. The strainer bodies shall be heavy and durable, fabricated of cast iron, and shall have bottoms drilled and tapped with a

gate valve attached for blowdown purposes. Strainers shall be designed for 125 psig service and 250 degrees F. The bodies shall have arrows clearly cast on the sides indicating the direction of flow. Each strainer shall be equipped with an easily removable cover and sediment screen. The screen shall be made of 22 gauge brass sheet with small perforations numbering not less than 400 per square inch to provide a net free area through the basket of at least 3.30 times that of the entering pipe. The flow shall be into the screen and out through the perforations.

#### 2.10.20 Pressure Gauges

Gauges shall conform to ASME B40.1 and shall be provided with throttling type needle valve or a pulsation dampener and shutoff valve. Minimum dial size shall be 3-1/2 inches. A pressure gauge shall be provided for each boiler in a visible location on the boiler. Pressure gauges shall be provided with readings in Kpa and psi. Pressure gauges shall have an indicating pressure range that is related to the operating pressure of the fluid in accordance with the following table:

Operating Pressure (kPa)	Pressure Range (kPa)
519-1030	0-1400
105-518	0-690
14-104	0-210 (retard)
Operating Pressure (psi)	Pressure Range (psi)
76-150	0-200
16-75	0-100
2-15	0-30 (retard)

#### 2.10.21 Thermometers

Thermometers shall be provided with wells and separable corrosion-resistant steel sockets. Mercury shall not be used in thermometers. Thermometers for inlet water and outlet water for each hot water boiler shall be provided in a visible location on the boiler. Thermometers shall have brass, malleable iron, or aluminum alloy case and frame, clear protective face, permanently stabilized glass tube with indicating-fluid column, white face, black numbers, and a minimum 9 inch scale. The operating range of the thermometers shall be 0-100 degrees centigrade (32 - 212 degrees Fahrenheit). The thermometers shall be provided with readings in degrees centigrade and Fahrenheit.

#### 2.10.22 Air Vents

##### 2.10.22.1 Manual Air Vents

Manual air vents shall be brass or bronze valves or cocks suitable for the pressure rating of the piping system and furnished with threaded plugs or caps.

##### 2.10.22.2 Automatic Air Vents

Automatic air vents shall be 3/4 inch quick-venting float and vacuum air valves. Each air vent valve shall have a large port permitting the expulsion of the air without developing excessive back pressure, a

noncollapsible metal float which will close the valve and prevent the loss of water from the system, an air seal that will effectively close and prevent the re-entry of air into the system when subatmospheric pressures prevail therein, and a thermostatic member that will close the port against the passage of steam from the system. The name of the manufacturer shall be clearly stamped on the outside of each valve. The air vent valve shall be suitable for the pressure rating of the piping system.

2.10.23 Not Used.

## 2.11 ELECTRICAL EQUIPMENT

Electric motor-driven equipment shall be provided complete with motors, motor starters, and necessary control devices. Electrical equipment, motor control devices, motor efficiencies and wiring shall be as specified in Section 16415A ELECTRICAL WORK, INTERIOR. Motors which are not an integral part of a packaged boiler shall be rated for high efficiency service. Motors which are an integral part of the packaged boiler shall be the highest efficiency available by the manufacturer of the packaged boiler. Motor starters shall be provided complete with properly sized thermal overload protections and other appurtenances necessary for the motor control specified. Starters shall be furnished in general purpose enclosures. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices but not shown shall be provided.

### 2.11.1 Motor Ratings

Motors shall be suitable for the voltage and frequency provided. Motors 1/2 hp and larger shall be three-phase, unless otherwise indicated. Motors shall be of sufficient capacity to drive the equipment at the specified capacity without exceeding the nameplate rating on the motor.

### 2.11.2 Motor Controls

Motor controllers shall be provided complete with properly sized thermal overload protection. Manual or automatic control and protective or signal devices required for the operation specified and any wiring required to such devices shall be provided. Where two-speed or variable-speed motors are indicated, solid-state variable-speed controllers may be provided to accomplish the same function. Solid state variable speed controllers shall be utilized for fractional through 10 hp ratings. Adjustable frequency drives shall be used for larger motors.

## 2.12 INSULATION

Shop and field-applied insulation shall be as specified in Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS.

## 2.13 TOOLS

Special tools shall be furnished. Special tools shall include uncommon tools necessary for the operation and maintenance of boilers, burners, pumps, fans, controls, meters, special piping systems, and other equipment. Small hand tools shall be furnished within a suitable cabinet, mounted where directed.

### 2.13.1 Breeching Cleaner

A cleaner shall be provided to clean the breeching. The cleaner shall have a jointed handle of sufficient length to clean the breeching without dismantling.

2.13.2 Not Used.

2.13.3 Tube Brush

If a firetube boiler is being furnished, a tube brush, with steel bristles and jointed handle of sufficient length to clean full length of firetubes, shall be provided.

2.13.4 Wrenches

Wrenches shall be provided as required for specialty fittings such as manholes, handholes, and cleanouts. One set of extra gaskets shall be provided for all manholes and handholes, for pump barrels, and other similar items of equipment. Gaskets shall be packaged and properly identified.

2.14 Not Used

2.15 BOILER WATER TREATMENT

The water treatment system shall be capable of feeding chemicals and bleeding the system to prevent corrosion and scale within the boiler and piping distribution system. The water shall be treated to maintain the conditions recommended by the boiler manufacturer. Chemicals shall meet required federal, state, and local environmental regulations for the treatment of boilers and discharge to the sanitary sewer. The services of a company regularly engaged in the treatment of boilers shall be used to determine the correct chemicals and concentrations required for water treatment. The company shall maintain the chemical treatment and provide all chemicals required for a period of 1 year from the date of occupancy. Filming amines and proprietary chemicals shall not be used. The water treatment chemicals shall remain stable throughout the operating temperature range of the system and shall be compatible with pump seals and other elements of the system.

2.15.1 MakeUp Water Analysis

A water analysis shall be conducted to determine the quality and condition of make-up water to be supplied to the hot water heating system.

2.15.2 Boiler Water Limits

The boiler manufacturer shall be consulted for the determination of the boiler water chemical composition limits. The boiler water limits shall be as follows unless dictated differently by the boiler manufacturer's recommendations:

Causticity	20-200 ppm
Total Alkalinity (CACO <sub>3</sub> )	900-1200 ppm
Phosphate	30-60 ppm
Tanin	Medium
Dissolved Solids	3000-5000 ppm
Suspended Solids	300 ppm Max
Sodium Sulfite	20-40 ppm Max
Silica	Less than 150 ppm

Dissolved Oxygen	Less than 7 ppm
Iron	10 ppm
pH (Condensate)	7 - 8
Sodium Sulfite	20-40 ppm
Hardness	Less than 2 ppm
pH	9.3 - 9.9

2.15.3 Not Used.

2.15.4 Not Used.

2.15.5 Not Used.

2.15.6 Not Used.

2.15.7 Not Used.

2.15.8 Not Used.

2.15.9 Not Used.

2.15.10 Chemical Shot Feeder

A shot feeder shall be provided as indicated. Size and capacity of feeder shall be based upon local requirements and water analysis. The feeder shall be furnished with an air vent, gauge glass, funnel, valves, fittings, and piping.

2.15.11 Not Used.

2.15.12 Test Kits

One test kit of each type required to determine the water quality as outlined within the operation and maintenance manuals shall be provided.

### PART 3 EXECUTION

#### 3.1 ERECTION OF BOILER AND AUXILIARY EQUIPMENT

Boiler and auxiliary equipment shall be installed in accordance with manufacturer's written instructions. Boiler breeching shall be as indicated with full provision for expansion and contraction between all interconnected components.

#### 3.2 PIPING INSTALLATION

Unless otherwise specified, nonboiler external pipe and fittings shall conform to the requirements of ASME B31.1. Pipe installed shall be cut accurately to suit field conditions, shall be installed without springing or forcing, and shall properly clear windows, doors, and other openings. Cutting or other weakening of the building structure to facilitate piping installation will not be permitted. Pipes shall be free of burrs, oil, grease and other foreign material and shall be installed to permit free expansion and contraction without damaging the building structure, pipe, pipe joints, or pipe supports. Changes in direction shall be made with fittings, except that bending of pipe 4 inches and smaller will be permitted provided a pipe bender is used and wide sweep bends are formed. The centerline radius of bends shall not be less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other

malformations will not be accepted. Vent pipes shall be carried through the roof as directed and shall be properly flashed. Unless otherwise indicated, horizontal supply mains shall pitch down in the direction of flow with a grade of not less than 1 inch in 40 feet. Open ends of pipelines and equipment shall be properly capped or plugged during installation to keep dirt or other foreign materials out of the systems. Pipe not otherwise specified shall be uncoated. Unless otherwise specified or shown, final connections to equipment shall be made with malleable-iron unions for steel pipe 2-1/2 inches or less in diameter and with flanges for pipe 3 inches or more in diameter. Unions for copper pipe or tubing shall be brass or bronze. Reducing fittings shall be used for changes in pipe sizes. In horizontal hot water lines, reducing fittings shall be eccentric type to maintain the top of the lines at the same level to prevent air binding.

### 3.2.1 Hot Water Piping and Fittings

Pipe shall be black steel or copper tubing. Fittings for steel piping shall be black malleable iron or cast iron to suit piping. Fittings adjacent to valves shall suit valve material. Grooved mechanical fittings will not be allowed.

### 3.2.2 Vent Piping and Fittings

Vent piping shall be black steel. Fittings shall be black malleable iron or cast iron to suit piping.

### 3.2.3 Gauge Piping

Piping shall be copper tubing.

### 3.2.4 Not Used.

### 3.2.5 Not Used.

### 3.2.6 Joints

Joints between sections of steel pipe and between steel pipe and fittings shall be threaded, flanged or welded as indicated or specified. Except as otherwise specified, fittings 1 inch and smaller shall be threaded; fittings 1-1/4 inches and up to but not including 3 inches shall be either threaded, or welded; and fittings 3 inches and larger shall be either flanged, or welded. Pipe and fittings 1-1/4 inches and larger installed in inaccessible conduit or trenches beneath concrete floor slabs shall be welded. Connections to equipment shall be made with black malleable-iron unions for pipe 2-1/2 inches or smaller in diameter and with flanges for pipe 3 inches or larger in diameter. Joints between sections of copper tubing or pipe shall be flared, soldered, or brazed.

#### 3.2.6.1 Threaded Joints

Threaded joints shall be made with tapered threads properly cut and shall be made perfectly tight with a stiff mixture of graphite and oil or with polytetrafluoroethylene tape applied to the male threads only and in no case to the fittings.

#### 3.2.6.2 Welded Joints

Welded joints shall be in accordance with paragraph GENERAL REQUIREMENTS

unless otherwise specified. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connections may be made with either welding tees or forged branch outlet fittings, either being acceptable without size limitation. Branch outlet fittings, where used, shall be forged, flared for improved flow characteristics where attached to the run, reinforced against external strains, and designed to withstand full pipe bursting strength. Socket weld joints shall be assembled so that the space between the end of the pipe and the bottom of the socket is no less than 1/16 inch and no more than 1/8 inch.

#### 3.2.6.3 Not Used.

#### 3.2.6.4 Flared and Brazed Copper Pipe and Tubing

Tubing shall be cut square, and burrs shall be removed. Both inside of fittings and outside of tubing shall be cleaned thoroughly with sand cloth or steel wire brush before brazing. Annealing of fittings and hard-drawn tubing shall not occur when making connections. Installation shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Brazed joints shall be made in conformance with AWS B2.2, MSS SP-73, and CDA Tube Handbook with flux. Copper-to-copper joints shall include the use of copper-phosphorous or copper-phosphorous-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-phosphorous, copper-phosphorous-silver or a silver brazing filler metal. Joints for flared fittings shall be of the compression pattern. Swing joints or offsets shall be provided in all branch connections, mains, and risers to provide for expansion and contraction forces without undue stress to the fittings or to short lengths of pipe or tubing. Flared or brazed copper tubing to pipe adapters shall be provided where necessary for joining threaded pipe to copper tubing.

#### 3.2.6.5 Soldered Joints

Soldered joints shall be made with flux and are only acceptable for lines 2 inches and smaller. Soldered joints shall conform to ASME B31.5 and CDA Tube Handbook.

#### 3.2.6.6 Copper Tube Extracted Joint

An extruded mechanical tee joint may be made in copper tube. Joint shall be produced with an appropriate tool by drilling a pilot hole and drawing out the tube surface to form a collar having a minimum height of three times the thickness of the tube wall. To prevent the branch tube from being inserted beyond the depth of the extracted joint, dimpled depth stops shall be provided. The branch tube shall be notched for proper penetration into fitting to assure a free flow joint. Extracted joints shall be brazed using a copper phosphorous classification brazing filler metal. Soldered joints will not be permitted.

#### 3.2.7 Flanges and Unions

Flanges shall be faced true, provided with 1/16 inch thick gaskets, and made square and tight. Where steel flanges mate with cast-iron flanged fittings, valves, or equipment, they shall be provided with flat faces and full face gaskets. Union or flange joints shall be provided in each line

immediately preceding the connection to each piece of equipment or material requiring maintenance such as coils, pumps, control valves, and other similar items. Dielectric pipe unions shall be provided between ferrous and nonferrous piping to prevent galvanic corrosion. The dielectric unions shall have metal connections on both ends. The ends shall be threaded, flanged, or brazed to match adjacent piping. The metal parts of the union shall be separated so that the electrical current is below 1 percent of the galvanic current which would exist upon metal-to-metal contact. Gaskets, flanges, and unions shall be installed in accordance with manufacturer's recommendations.

### 3.2.8 Branch Connections

#### 3.2.8.1 Branch Connections for Hot Water Systems

Branches from the main shall pitch up or down as shown to prevent air entrapment. Connections shall ensure unrestricted circulation, eliminate air pockets, and permit complete drainage of the system. Branches shall pitch with a grade of not less than 1 inch in 10 feet. When indicated, special flow fittings shall be installed on the mains to bypass portions of the water through each radiator. Special flow fittings shall be standard catalog products and shall be installed as recommended by the manufacturer.

#### 3.2.8.2 Not Used.

#### 3.2.9 Not Used.

#### 3.2.10 Not Used.

#### 3.2.11 Not Used.

#### 3.2.12 Flared, Brazed, and Soldered Copper Pipe and Tubing

Copper tubing shall be flared, brazed, or soldered. Tubing shall be cut square, and burrs shall be removed. Both inside of fittings and outside of tubing shall be cleaned thoroughly with sand cloth or steel wire brush before brazing. Annealing of fittings and hard-drawn tubing shall not occur when making connections. Installation shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints for flared fittings shall be of the compression pattern. Swing joints or offsets shall be provided on branch connections, mains, and risers to provide for expansion and contraction forces without undue stress to the fittings or to short lengths of pipe or tubing. Pipe adapters shall be provided where necessary for joining threaded pipe to copper tubing. Brazed joints shall be made in conformance with MSS SP-73, and CDA Tube Handbook. Copper-to-copper joints shall include the use of copper-phosphorous or copper-phosphorous-silver brazing metal without flux.

Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-phosphorous, copper-phosphorous-silver, or a silver brazing filler metal. Soldered joints shall be made with flux and are only acceptable for lines 2 inches or smaller. Soldered joints shall conform to ASME B31.5 and shall be in accordance with CDA Tube Handbook.

#### 3.2.13 Copper Tube Extracted Joint

Copper tube extracted joints shall not be used.

#### 3.2.14 Supports

Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers. Threaded rods which are used for support shall not be formed or bent.

3.2.14.1 Not Used

3.2.14.2 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69, except as modified herein.

- a. Types 5, 12, and 26 shall not be used.
- b. Type 3 shall not be used on insulated pipe which has a vapor barrier. Type 3 may be used on insulated pipe that does not have a vapor barrier if clamped directly to the pipe, if the clamp bottom does not extend through the insulation, and if the top clamp attachment does not contact the insulation during pipe movement.
- c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for Type 18 inserts.
- d. Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and have both locknuts and retaining devices furnished by the manufacturer. Field fabricated C-clamp bodies or retaining devices are not acceptable.
- e. Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.
- f. Type 24 may be used only on trapeze hanger systems or on fabricated frames.
- g. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves.
- h. Vertical pipe shall be supported at each floor, except at slab-on-grade, and at intervals of not more than 15 feet, not more than 8 feet from end of risers, and at vent terminations.
- i. Type 35 guides using steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided where required to allow longitudinal pipe movement. Lateral restraints shall be provided as required. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered.

(1) Where steel slides do not require provisions for restraint of lateral movement, an alternate guide method may be used. On

piping 4 inches and larger, a Type 39 saddle may be welded to the pipe and freely rested on a steel plate. On piping under 4 inches, a Type 40 protection shield may be attached to the pipe or insulation and freely rested on a steel slide plate.

(2) Where there are high system temperatures and welding to piping is not desirable, the Type 35 guide shall include a pipe cradle welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 4 inches or by an amount adequate for the insulation, whichever is greater.

- j. Except for Type 3, pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation.
- k. Piping in trenches shall be supported as indicated.
- l. Structural steel attachments and brackets required to support piping, headers, and equipment, but not shown, shall be provided under this section. Material and installation shall be as specified under Section 05120A STRUCTURAL STEEL. Pipe hanger loads suspended from steel joist between panel points shall not exceed 50 pounds. Loads exceeding 50 pounds shall be suspended from panel points.

#### 3.2.14.3 Multiple Pipe Runs

In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support member shall not exceed the hanger and support spacing required for any individual pipe in the multiple pipe run. The clips or clamps shall be rigidly attached to the common base member. A clearance of 1/8 inch shall be provided between the pipe insulation and the clip or clamp for piping which may be subjected to thermal expansion.

#### 3.2.15 Anchors

Anchors shall be provided where necessary to localize expansion or to prevent undue strain on piping. Anchors shall consist of heavy steel collars with lugs and bolts for clamping and attaching anchor braces, unless otherwise indicated. Anchor braces shall be installed in the most effective manner to secure the desired results, using turnbuckles where required. Supports, anchors, or stays shall not be attached where they will injure the structure or adjacent construction during installation or by the weight of expansion of the pipeline.

#### 3.2.16 Valves

Valves shall be installed where indicated, specified, and required for functioning and servicing of the systems. Valves shall be safely accessible. Swing check valves shall be installed upright in horizontal lines and in vertical lines only when flow is in the upward direction. Gate and globe valves shall be installed with stems horizontal or above. Valves to be brazed shall be disassembled prior to brazing and all packing removed. After brazing, the valves shall be allowed to cool before reassembling.

#### 3.2.17 Pipe Sleeves

Pipe passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. A waterproofing clamping flange shall be installed as indicated where membranes are involved. Sleeves shall not be installed in structural members except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective wall, floor, or roof. Sleeves through walls shall be cut flush with wall surface. Sleeves through floors shall extend above top surface of floor a sufficient distance to allow proper flashing or finishing. Sleeves through roofs shall extend above the top surface of roof at least 6 inches for proper flashing or finishing. Unless otherwise indicated, sleeves shall be sized to provide a minimum clearance of 1/4 inch between bare pipe and sleeves or between jacket over insulation and sleeves. Sleeves in waterproofing membrane floors, bearing walls, and wet areas shall be galvanized steel pipe or cast-iron pipe. Sleeves in nonbearing walls, floors, or ceilings may be galvanized steel pipe, cast-iron pipe, or galvanized sheet metal with lock-type longitudinal seam. Except in pipe chases or interior walls, the annular space between pipe and sleeve or between jacket over insulation and sleeve in nonfire rated walls shall be sealed as indicated and specified in Section 07900A JOINT SEALING. Metal jackets shall be provided over insulation passing through exterior walls, firewalls, fire partitions, floors, or roofs.

- a. Metal jackets shall not be thinner than 0.006 inch thick aluminum, if corrugated, and 0.016 inch thick aluminum, if smooth.
- b. Metal jackets shall be secured with aluminum or stainless steel bands not less than 3/8 inch wide and not more than 8 inches apart. When penetrating roofs and before fitting the metal jacket into place, a 1/2 inch wide strip of sealant shall be run vertically along the inside of the longitudinal joint of the metal jacket from a point below the backup material to a minimum height of 36 inches above the roof. If the pipe turns from vertical to horizontal, the sealant strip shall be run to a point just beyond the first elbow. When penetrating waterproofing membrane for floors, the metal jacket shall extend from a point below the back-up material to a minimum distance of 2 inches above the flashing. For other areas, the metal jacket shall extend from a point below the backup material to a point 12 inches above the flashing. For other areas, the metal jacket shall extend from a point below the backup material to a point 12 inches above the floor; when passing through walls above grade, the jacket shall extend at least 4 inches beyond each side of the wall.

#### 3.2.17.1 Pipes Passing Through Waterproofing Membranes

In addition to the pipe sleeves referred to above, pipes passing through waterproofing membranes shall be provided with a 4 pound lead flashing or a 16 ounce copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than inches from the pipe and shall set over the membrane in a troweled coating of bituminous cement. The flashing shall extend above the roof or floor a minimum of 10 inches. The annular space between the flashing and the bare pipe or between the flashing and the metal-jacket-covered insulation shall be sealed as indicated. Pipes up to and including 10 inches in diameter which pass through waterproofing membrane may be installed through a cast-iron sleeve with caulking recess, anchor lugs, flashing clamp device, and pressure ring with brass bolts.

Waterproofing membrane shall be clamped into place and sealant shall be placed in the caulking recess.

#### 3.2.17.2 Optional Modular Mechanical Sealing Assembly

At the option of the Contractor, a modular mechanical type sealing assembly may be installed in the annular space between the sleeve and conduit or pipe in lieu of a waterproofing clamping flange and caulking and sealing specified above. The seals shall include interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe/conduit and sleeve with corrosion-protected carbon steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe/conduit and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe/conduit and sleeve involved.

#### 3.2.17.3 Optional Counterflashing

As alternates to caulking and sealing the annular space between the pipe and flashing or metal-jacket-covered insulation and flashing, counterflashing may consist of standard roof coupling for threaded pipe up to 6 inches in diameter, lead flashing sleeve for dry vents with the sleeve turned down into the pipe to form a waterproof joint, or a tack-welded or banded-metal rain shield around the pipe, sealed as indicated.

#### 3.2.17.4 Fire Seal

Where pipes pass through firewalls, fire partitions, or floors, a fire seal shall be provided as specified in Section 07840A FIRESTOPPING.

#### 3.2.18 Balancing Valves

Balancing valves shall be installed as indicated.

#### 3.2.19 Thermometer Wells

A thermometer well shall be provided in each return line for each circuit in multicircuit systems.

#### 3.2.20 Air Vents

Air vents shall be installed where shown or directed. Air vents shall be installed in piping at all system high points. The vent shall remain open until water rises in the tank or pipe to a predetermined level at which time it shall close tight. An overflow pipe from the vent shall be run to a point designated by the Contracting Officer's representative. The inlet to the air vent shall have a gate valve or ball valve.

#### 3.2.21 Escutcheons

Escutcheons shall be provided at all finished surfaces where exposed piping, bare or insulated, passes through floors, walls, or ceilings except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be chromium-plated iron or chromium-plated brass, either one-piece or split pattern, held in place by internal spring tension or setscrews.

### 3.2.22 Drains

A drain connection with a 1 inch gate valve or 3/4 inch hose bib shall be installed at the lowest point in the return main near the boiler. In addition, threaded drain connections with threaded cap or plug shall be installed on the heat exchanger coil on each unit heater or unit ventilator and wherever required for thorough draining of the system.

### 3.2.23 Not Used.

### 3.2.24 Direct Venting for Exhaust Air

The vents shall be installed in accordance with NFPA 54 and boiler manufacturer's recommendations. The exhaust vent shall be sloped 1/4 inch per ft toward the boiler's flue gas condensate collection point.

## 3.3 GAS FUEL SYSTEM

Gas piping, fittings, valves, regulators, tests, cleaning, and adjustments shall be in accordance with the Section 15190A GAS PIPING SYSTEMS. NFPA 54 shall be complied with unless otherwise specified. Burners, pilots, and all accessories shall be listed in UL Gas&Oil Dir. The fuel system shall be provided with a gas tight, manually operated, UL listed stop valve at the gas-supply connections, a gas strainer, a pressure regulator, pressure gauges, a burner-control valve, a safety shutoff valve suitable for size of burner and sequence of operation, and other components required for safe, efficient, and reliable operation as specified. Approved permanent and ready facilities to permit periodic valve leakage tests on the safety shutoff valve or valves shall be provided.

## 3.4 UNIT HEATERS

Unit heaters shall be installed as indicated and in accordance with the manufacturer's instructions.

## 3.5 Not Used

## 3.6 COLOR CODE MARKING AND FIELD PAINTING

Color code marking of piping shall be as specified in Section 09900 PAINTS AND COATINGS. Ferrous metal not specified to be coated at the factory shall be cleaned, prepared, and painted as specified in Section 09900 PAINTS AND COATINGS. Exposed pipe covering shall be painted as specified in Section 09900 PAINTS AND COATINGS. Aluminum sheath over insulation shall not be painted.

## 3.7 TEST OF BACKFLOW PREVENTION ASSEMBLIES

Backflow prevention assemblies shall be tested in accordance with Section 15400A PLUMBING, GENERAL PURPOSE.

## 3.8 HEATING SYSTEM TESTS

Before any covering is installed on pipe or heating equipment, the entire heating system's piping, fittings, and terminal heating units shall be hydrostatically tested and proved tight at a pressure of 1-1/2 times the design working pressure, but not less than 100 psi. Before pressurizing system for test, items or equipment (e.g., vessels, pumps, instruments,

controls, relief valves) rated for pressures below the test pressure shall be blanked off or replaced with spool pieces. Before balancing and final operating test, test blanks and spool pieces shall be removed; and protected instruments and equipment shall be reconnected. With equipment items protected, the system shall be pressurized to test pressure. Pressure shall be held for a period of time sufficient to inspect all welds, joints, and connections for leaks, but not less than 2 hours. No loss of pressure will be allowed. Leaks shall be repaired and repaired joints shall be retested. Repair joints shall not be allowed under the floor for floor radiant heating systems. If a leak occurs in tubing located under the floor in radiant heating systems, the entire zone that is leaking shall be replaced. If any repair is made above the floor for floor radiant heating systems, access shall be provided for the installed joint. Caulking of joints shall not be permitted. System shall be drained and after instruments and equipment are reconnected, the system shall be refilled with service medium and maximum operating pressure applied. The pressure shall be held while inspecting these joints and connections for leaks. The leaks shall be repaired and the repaired joints retested. Upon completion of hydrostatic tests and before acceptance of the installation, the Contractor shall balance the heating system in accordance with Section 15990A TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS; and operating tests required to demonstrate satisfactory functional and operational efficiency shall be performed. The operating test shall cover a period of at least 24 hours for each system, and shall include, as a minimum, the following specific information in a report, together with conclusions as to the adequacy of the system:

- a. Certification of balancing.
- b. Time, date, and duration of test.
- c. Outside and inside dry bulb temperatures.
- d. Temperature of hot water supply leaving boiler.
- e. Temperature of heating return water from system at boiler inlet.
- f. Quantity of water feed to boiler.
- g. Boiler make, type, serial number, design pressure, and rated capacity.
- h. Fuel burner make, model, and rated capacity; ammeter and voltmeter readings for burner motor.
- i. Circulating pump make, model, and rated capacity, and ammeter and voltmeter readings for pump motor during operation.
- j. Flue-gas temperature at boiler outlet.
- k. Percent carbon dioxide in flue-gas.
- l. Grade or type and calorific value of fuel.
- m. Draft at boiler flue-gas exit.
- n. Draft or pressure in furnace.
- o. Quantity of water circulated.

- p. Quantity of fuel consumed.
- q. Stack emission pollutants concentration.

Indicating instruments shall be read at half-hour intervals unless otherwise directed. The Contractor shall furnish all instruments, equipment, and personnel required for the tests and balancing. Fuels, water, and electricity shall be obtained as specified in the SPECIAL CONTRACT REQUIREMENTS. . Operating tests shall demonstrate that fuel burners and combustion and safety controls meet the requirements of ASME CSD-1, ANSI Z21.13, and NFPA 85

### 3.8.1 Water Treatment Testing

#### 3.8.1.1 Water Quality Test

The boiler water shall be analyzed prior to the acceptance of the facility by the water treatment company. The analysis shall include the following information recorded in accordance with ASTM D 596.

Date of Sample	[_____]
Temperature	[_____] degrees F
Silica (SiO <sub>2</sub> )	[_____] ppm (mg/1)
Insoluble	[_____] ppm (mg/1)
Iron and Aluminum Oxides	[_____] ppm (mg/1)
Calcium (Ca)	[_____] ppm (mg/1)
Magnesium (Mg)	[_____] ppm (mg/1)
Sodium and Potassium (Na and K)	[_____] ppm (mg/1)
Carbonate (HCO <sub>3</sub> )	[_____] ppm (mg/1)
Sulfate (SO <sub>4</sub> )	[_____] ppm (mg/1)
Chloride (Cl)	[_____] ppm (mg/1)
Nitrate (NO <sub>3</sub> )	[_____] ppm (mg/1)
Turbidity	[_____] unit
pH	[_____]
Residual Chlorine	[_____] ppm (mg/1)
Total Alkalinity	[_____] epm (meq/1)
Noncarbonate Hardness	[_____] epm (meq/1)
Total Hardness	[_____] epm (meq/1)
Dissolved Solids	[_____] ppm (mg/1)
Fluorine	[_____] ppm (mg/1)
Conductivity	[_____] micro-mho/cm

If the boiler water is not in conformance with the boiler manufacturer's recommendations, the water treatment company shall take corrective action.

#### 3.8.1.2 Boiler/Piping Test

At the conclusion of the 1 year period, the boiler and condensate piping shall be inspected for problems due to corrosion and scale. If the boiler is found not to conform to the manufacturer's recommendations, and the water treatment company recommendations have been followed, the water treatment company shall provide all chemicals and labor for cleaning or repairing the equipment as required by the manufacturer's recommendations. If corrosion is found within the condensate piping, proper repairs shall be made by the water treatment company.

### 3.9 CLEANING

### 3.9.1 Boilers and Piping

After the hydrostatic tests have been made and before the system is balanced and operating tests are performed, the boilers and feed water piping shall be thoroughly cleaned by filling the system with a solution consisting of either 1 pound of caustic soda or 1 pound of trisodium phosphate per 50 gallons of water. The proper safety precautions shall be observed in the handling and use of these chemicals. The water shall be heated to approximately 150 degrees F and the solution circulated in the system for a period of 48 hours. The system shall then be drained and thoroughly flushed out with fresh water. The Contractor shall be responsible for disposal of the flushing water. Strainers and valves shall be thoroughly cleaned. Prior to operating tests, air shall be removed from all water systems by operating the air vents.

### 3.9.2 Heating Units

Inside space heating equipment, ducts, plenums, and casing shall be thoroughly cleaned of debris and blown free of small particles of rubbish and dust and then vacuum cleaned before installing outlet faces. Equipment shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. Temporary filters shall be provided for fans that are operated during construction, and new filters shall be installed after construction dirt has been removed from the building, and the ducts, plenum, casings, and other items specified have been vacuum cleaned. System shall be maintained in this clean condition until final acceptance. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension. Control valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or directed. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

## 3.10 FUEL SYSTEM TESTS

### 3.10.1 Not Used.

### 3.10.2 Gas System Test

The gas fuel system shall be tested in accordance with the test procedures outlined in NFPA 54.

## 3.11 FIELD TRAINING

The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 8 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. The field instructions shall cover all of the items contained in the approved operation and maintenance instructions, as well as demonstrations of routine maintenance operations and boiler safety devices. The Contracting Officer shall be notified at least 14 days prior to date of proposed conduction of the training course.

-- End of Section --

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SECTION 15700A

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## SECTION 15700A

UNITARY HEATING AND COOLING EQUIPMENT  
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## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 340/360 (1993) Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment

ARI 700 (1999) Specifications for Fluorocarbon and Other Refrigerants

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 307 (2000) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

ASTM C 1071 (1998) Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material)

ASTM E 437 (1992; R 1997) Industrial Wire Cloth and Screens (Square Opening Series)

ASTM E 84 (2000a) Surface Burning Characteristics of Building Materials

ASTM F 104 (1995) Nonmetallic Gasket Materials

## AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 15 (1994) Safety Code for Mechanical Refrigeration

ASHRAE 34 (1997) Number Designation and Safety Classification of Refrigerants

ASHRAE 52.1 (1992) Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter

## AMERICAN WELDING SOCIETY (AWS)

AWS Z49.1 (1999) Safety in Welding and Cutting

## ASME INTERNATIONAL (ASME)

ASME BPVC SEC IX	(1998) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications
ASME BPVC SEC VIII D1	(1998) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage
NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)	
NEMA MG 1	(1998) Motors and Generators
NEMA MG 2	(1989) Safety Standard for Construction and Guide for Selection, Installation, and Use of Electric Motors and Generators
UNDERWRITERS LABORATORIES (UL)	
UL 1995	(1995; Rev thru Aug 1999) Heating and Cooling Equipment
UL 207	(1993; Rev thru Oct 1997) Refrigerant-Containing Components and Accessories, Nonelectrical
UL 900	(1994; Rev thru Nov 1999) Test Performance of Air Filter Units

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

#### Drawings; G-DO

Drawings provided in adequate detail to demonstrate compliance with contract requirements. Drawings shall consist of:

- a. Equipment layouts which identify assembly and installation details.
- b. Plans and elevations which identify clearances required for maintenance and operation.
- c. Wiring diagrams which identify each component individually and interconnected or interlocked relationships between components.
- d. Foundation drawings, bolt-setting information, and foundation bolts prior to concrete foundation construction for equipment indicated or required to have concrete foundations.
- e. Details, if piping and equipment are to be supported other

than as indicated, which include loadings and type of frames, brackets, stanchions, or other supports.

f. Automatic temperature control diagrams and control sequences.

g. Installation details which includes the amount of factory set superheat and corresponding refrigerant pressure/temperature.

#### SD-03 Product Data

##### Unitary Equipment; G-DO

Manufacturer's standard catalog data, at least 5 weeks prior to the purchase or installation of a particular component, highlighted to show material, size, options, performance charts and curves, etc. in adequate detail to demonstrate compliance with contract requirements. Data shall include manufacturer's recommended installation instructions and procedures. If vibration isolation is specified for a unit, vibration isolator literature shall be included containing catalog cuts and certification that the isolation characteristics of the isolators provided meet the manufacturer's recommendations. Data shall be submitted for each specified component.

##### Spare Parts Data;

Spare parts data for each different item of equipment specified, after approval of detail drawings and not later than two months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, a recommended spare parts list for 1 year of operation, and a list of the parts recommended by the manufacturer to be replaced on a routine basis.

##### Posted Instructions; G-AO

Posted instructions, at least 2 weeks prior to construction completion, including equipment layout, wiring and control diagrams, piping, valves and control sequences, and typed condensed operation instructions. The condensed operation instructions shall include preventative maintenance procedures, methods of checking the system for normal and safe operation, and procedures for safely starting and stopping the system. The posted instructions shall be framed under glass or laminated plastic and be posted where indicated by the Contracting Officer.

##### Verification of Dimensions; G-AO

A letter, at least 2 weeks prior to beginning construction, including the date the site was visited, conformation of existing conditions, and any discrepancies found.

##### System Performance Tests; G-AO

A schedule, at least 2 weeks prior to the start of related testing, for the system performance tests. The schedules shall identify the proposed date, time, and location for each test.

##### Demonstrations; G-AO

A schedule, at least 2 weeks prior to the date of the proposed training course, which identifies the date, time, and location for the training.

#### SD-06 Test Reports

##### Refrigerant Tests, Charging, and Start-Up; G-AO

Six copies of each test containing the information described below in bound 8-1/2 x 11 inch booklets. Individual reports shall be submitted for the refrigerant system tests.

- a. The date the tests were performed.
- b. A list of equipment used, with calibration certifications.
- c. Initial test summaries.
- d. Repairs/adjustments performed.
- e. Final test results.

##### System Performance Tests; G-AO

Six copies of the report provided in bound 8-1/2 x 11 inch booklets. The report shall document compliance with the specified performance criteria upon completion and testing of the system. The report shall indicate the number of days covered by the tests and any conclusions as to the adequacy of the system. The report shall also include the following information and shall be taken at least three different times at outside dry-bulb temperatures that are at least 5 degrees F apart:

- a. Date and outside weather conditions.
- b. The load on the system based on the following:
  - (1) The refrigerant used in the system.
  - (2) Condensing temperature and pressure.
  - (3) Suction temperature and pressure.
  - (4) Ambient, condensing and coolant temperatures.
  - (5) Running current, voltage and proper phase sequence for each phase of all motors.
- c. The actual on-site setting of operating and safety controls.
- d. Thermostatic expansion valve superheat - value as determined by field test.
- e. Subcooling.
- f. High and low refrigerant temperature switch set-points
- g. Low oil pressure switch set-point.
- h. Defrost system timer and thermostat set-points.
- i. Moisture content.

- j. Capacity control set-points.
- k. Field data and adjustments which affect unit performance and energy consumption.
- l. Field adjustments and settings which were not permanently marked as an integral part of a device.

#### SD-07 Certificates

##### Unitary Equipment; G-DO

Where the system, components, or equipment are specified to comply with requirements of ARI, ASHRAE, ASME, or UL, proof of such compliance shall be provided. The label or listing of the specified agency shall be acceptable evidence. In lieu of the label or listing, a written certificate from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency may be submitted. When performance requirements of this project's drawings and specifications vary from standard ARI rating conditions, computer printouts, catalog, or other application data certified by ARI or a nationally recognized laboratory as described above shall be included. If ARI does not have a current certification program that encompasses such application data, the manufacturer may self certify that his application data complies with project performance requirements in accordance with the specified test standards.

##### Service Organization;

A certified list of qualified permanent service organizations, which includes their addresses and qualifications, for support of the equipment. The service organizations shall be reasonably convenient to the equipment installation and be able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

#### SD-10 Operation and Maintenance Data

##### Operation Manuals; G-AO

Six complete copies of an operation manual in bound 8 1/2 x 11 inch booklets listing step-by-step procedures required for system startup, operation, abnormal shutdown, emergency shutdown, and normal shutdown at least 4 weeks prior to the first training course. The booklets shall include the manufacturer's name, model number, and parts list. The manuals shall include the manufacturer's name, model number, service manual, and a brief description of all equipment and their basic operating features.

##### Maintenance Manuals; G-AO

Six complete copies of maintenance manual in bound 8-1/2 x 11 inch booklets listing routine maintenance procedures, possible breakdowns and repairs, and a trouble shooting guide. The manuals shall include piping and equipment layouts and simplified wiring

and control diagrams of the system as installed.

### 1.3 SAFETY REQUIREMENTS

Exposed moving parts, parts that produce high operating temperature, parts which may be electrically energized, and parts that may be a hazard to operating personnel shall be insulated, fully enclosed, guarded, or fitted with other types of safety devices. Safety devices shall be installed so that proper operation of equipment is not impaired. Welding and cutting safety requirements shall be in accordance with AWS Z49.1.

### 1.4 DELIVERY, STORAGE, AND HANDLING

Stored items shall be protected from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Proper protection and care of all material both before and during installation shall be the Contractor's responsibility. Any materials found to be damaged shall be replaced at the Contractor's expense. During installation, piping and similar openings shall be capped to keep out dirt and other foreign matter.

### 1.5 PROJECT/SITE CONDITIONS

#### 1.5.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

#### 1.5.2 Drawings

Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. The Contractor shall carefully investigate the plumbing, fire protection, electrical, structural and finish conditions that would affect the work to be performed and arrange such work accordingly, furnishing required offsets, fittings, and accessories to meet such conditions.

## PART 2 PRODUCTS

### 2.1 STANDARD COMMERCIAL PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of such products, which are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2 year use shall include applications of equipment and materials under similar circumstances and of similar size. The 2 years experience shall be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturer's catalogs, or brochures. Products having less than a 2 year field service record shall be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. Products shall be supported by a service organization. System components shall be environmentally suitable for the indicated locations.

### 2.2 NAMEPLATES

Major equipment including compressors, condensers, receivers, heat

exchanges, fans, and motors shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

### 2.3 ELECTRICAL WORK

Electrical equipment, motors, motor efficiencies, and wiring shall be in accordance with Section 16415A ELECTRICAL WORK, INTERIOR. Electrical motor driven equipment specified shall be provided complete with motors, motor starters, and controls. Electrical characteristics shall be as shown, and unless otherwise indicated, all motors of 1 horsepower and above with open, dripproof, totally enclosed, or explosion proof fan cooled enclosures, shall be high efficiency type. Field wiring shall be in accordance with manufacturer's instructions. Each motor shall conform to NEMA MG 1 and NEMA MG 2 and be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Motors shall be continuous duty with the enclosure specified. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary for the motor control indicated. Motors shall be furnished with a magnetic across-the-line or reduced voltage type starter as required by the manufacturer. Motor duty requirements shall allow for maximum frequency start-stop operation and minimum encountered interval between start and stop. Motors shall be sized for the applicable loads. Motor torque shall be capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Motor bearings shall be fitted with grease supply fittings and grease relief to outside of enclosure. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices specified, but not shown, shall be provided.

### 2.4 UNITARY EQUIPMENT, PACKAGE WATER-SOURCE HEAT PUMP SYSTEM

Unit shall be an water-cooled factory assembled, indoor packaged unit as indicated. Unit shall be the heat pump type conforming to applicable Underwriters Laboratories (UL) standards including UL 1995. Unit shall be rated in accordance with ARI 340/360. Unit shall be provided with equipment as specified in paragraph "Unitary Equipment Components". Evaporator or supply fans shall be double-width, double inlet, forward curved, backward inclined, or airfoil blade, centrifugal scroll type. Motors shall have dripproof enclosures. Unit shall be provided with a factory operating charge of refrigerant and oil or a holding charge. Unit shipped with a holding charge shall be field charged with refrigerant and oil in accordance with manufacturer's recommendations. . Water-cooled unit shall be fitted with a strainer protected modulating solenoid valve. The valve shall be a fully automatic, self-contained temperature or pressure regulating type as determined by the heat pump manufacturer.

#### 2.4.1 Air-to-Refrigerant Coils

Air-to-refrigerant coils shall have copper or aluminum tubes of 3/8 inch minimum diameter with copper or aluminum fins that are mechanically bonded or soldered to the tubes. Coils shall be protected with a minimum 3 mil thick phenolic or vinyl coating. Casing shall be galvanized steel or aluminum. Contact of dissimilar metals shall be avoided. Coils shall be tested in accordance with ASHRAE 15 at the factory and be suitable for the working pressure of the installed system. Each coil shall be dehydrated and sealed after testing and prior to evaluation and charging. Each unit shall be provided with a factory operating charge of refrigerant and oil or

a holding charge. Unit shipped with a holding charge shall be field charged. Separate expansion devices shall be provided for each compressor circuit.

#### 2.4.2 Water-to-Refrigerant Coils

Coils shall be of the tube-in-tube type and be provided as an integral part of the packaged unit. Water-wetted metals shall be copper-nickel. Coils shall be rated for not less than 400 psi refrigerant side and 125 psi water side pressure service at operating temperatures. Coils shall be supplied with water as indicated. Water supply, return and control system wetted parts shall be copper, bronze or stainless steel. Water supply, return connections and piping internal to unit shall be copper with brazed or threaded copper or bronze fittings, terminating in a threaded connection. Piping arrangement shall include valved access for recirculation of acidic scale removal chemicals and isolation pressure taps to determine pressure drop and water flow. Performance shall be based on an allowable water velocity not less than 3 fps nor more than 10 fps with a fouling factor of 0.001.

#### 2.4.3 Unit Copper Tubing

Copper tubing provided with the unit shall be created from a 99% pure copper formation that conforms to ASTM B743 for seamless, light-annealed processing.

#### 2.4.4 Compressor

Compressors shall be direct drive, hermetic reciprocating capable of operating at partial load conditions. Compressors shall be capable of continuous operation down to the lowest step of capacity reduction. Compressors of 10 tons and larger shall be provided with capacity reduction devices to produce automatic capacity reduction of at least 50 percent. If standard with the manufacturer, two or more compressors may be used in lieu of a single compressor with unloading capabilities, in which case the compressors shall operate in sequence, and each compressor shall have an independent refrigeration circuit through the condenser and evaporator. Compressors shall start in the unloaded position. Each compressor shall be provided with vibration isolators, thermal overloads, high and low pressure safety cutoffs and protection against short cycling.

#### 2.4.5 Refrigeration Circuit

Refrigerant containing components shall comply with ASHRAE 15 and be factory tested, cleaned, dehydrated, charged, and sealed. Refrigerant charging valves and connections, and pumpdown valves shall be provided for each circuit. Filter-drier shall be provided in each liquid line and be reversible-flow type. Refrigerant flow control devices shall be an adjustable superheat thermostatic expansion valve with external equalizer matched to coil, capillary or thermostatic control, and a pilot solenoid controlled, leak-tight, four-way refrigerant flow reversing valve.

#### 2.4.6 Unit Controls

Unit shall be internally prewired with a 24 volt control circuit powered by an internal transformer. Terminal blocks shall be provided for power wiring and external control wiring. Unit shall have cutoffs for high and low pressure, and low oil pressure for compressors with positive displacement oil pumps, and safety interlocks on all service panels. Head pressure controls shall sustain unit operation by modulating a solenoid

valve in the water supply line to the unit heat exchanger. Adjustable-cycle timers shall prevent short-cycling. Multiple compressors shall be staged by means of a time delay. Unit shall be internally protected by fuses or a circuit breaker in accordance with UL 1995. Low cost cooling shall be made possible by means of a control circuit which will modulate dampers to provide 100 percent outside air while locking out compressors (see drawing control sequence on sheet M6.03).

## 2.5 EQUIPMENT EFFICIENCY

Unit shall have an efficiency at the corresponding water temperatures as indicated on the drawings schedules sheet M5.02.

## 2.6 UNITARY EQUIPMENT COMPONENTS

### 2.6.1 Refrigerant and Oil

Refrigerant shall be one of the fluorocarbon gases. Refrigerants shall have number designations and safety classifications in accordance with ASHRAE 34. Refrigerants shall meet the requirements of ARI 700 as a minimum. Refrigerants shall have an Ozone Depletion Potential (ODP) of less than or equal to 0.05. Contractor shall provide and install a complete charge of refrigerant for the installed system as recommended by the manufacturer.

### 2.6.2 Fans

Fan wheel shafts shall be supported by either maintenance-accessible lubricated antifriction block-type bearings, or permanently lubricated ball bearings. Unit fans shall be selected to produce the cfm required at the fan total pressure. Motor starters, if applicable, shall be magnetic across-the-line type with a dripproof enclosure. Thermal overload protection shall be of the manual or automatic-reset type. Fan wheels shall be constructed of aluminum or galvanized steel. Centrifugal fan wheel housings shall be of galvanized steel, and fan casings shall be constructed of aluminum or galvanized steel. Steel elements of fans, except fan shafts, shall be hot-dipped galvanized after fabrication or fabricated of mill galvanized steel. Mill-galvanized steel surfaces and edges damaged or cut during fabrication by forming, punching, drilling, welding, or cutting shall be recoated with an approved zinc-rich compound. Fan wheels or propellers shall be statically and dynamically balanced. Direct-drive fan motors shall be of the multiple-speed variety. Belt-driven fans shall have adjustable sheaves to provide not less than 50 percent fan-speed adjustment. The sheave size shall be selected so that the fan speed at the approximate midpoint of the sheave adjustment will produce the specified air quantity. Centrifugal scroll-type fans shall be provided with streamlined orifice inlet and V-belt drive. Each drive will be independent of any other drive. Propeller fans shall be V-belt drive type with adjustable pitch blades. V-belt driven fans shall be mounted on a corrosion protected drive shaft supported by either maintenance-accessible lubricated antifriction block-type bearings, or permanently lubricated ball bearings. Each drive will be independent of any other drive. Drive bearings shall be protected with water slingers or shields. V-belt drives shall be fitted with guards where exposed to contact by personnel and adjustable pitch sheaves.

### 2.6.3 Not Used.

#### 2.6.3.1 Not Used

## 2.6.3.2 Not Used

## 2.6.3.3 Not Used

## 2.6.4 Air Filters

Air filters shall be listed in accordance with requirements of UL 900.

## 2.6.4.1 Not Used

## 2.6.4.2 Replaceable Media Filters

Replaceable media filters shall be the dry-media type, of the size required to suit the application. Filtering media shall be not less than 2 inches thick fibrous glass media pad supported by a structural wire grid or woven wire mesh. Pad shall be enclosed in a holding frame of not less than 16 gauge galvanized steel, and equipped with quick-opening mechanism for changing filter media. The air flow capacity of the filter shall be based on net filter face velocity not exceeding 300 feet per minute, with initial resistance of 0.13 inches water gauge. Average efficiency shall be not less than 30 percent when tested in accordance with ASHRAE 52.1.

## 2.6.4.3 Not Used

## 2.6.5 Coil Frost Protection

Each circuit shall be provided with a coil frost protection system which is a manufacturer's standard. The coil frost protection system shall use a temperature sensor in the suction line of the compressor to shut the compressor off when coil frosting occurs. Timers shall be used to prevent the compressor from rapid cycling.

## 2.6.6 Pressure Vessels

Pressure vessels shall conform to ASME BPVC SEC VIII D1 or UL 207, as applicable for maximum and minimum pressure or temperature encountered. Where referenced publications do not apply, pressure components shall be tested at 1-1/2 times design working pressure. Refrigerant wetted carbon steel surfaces shall be pickled or abrasive blasted free of mill scale, cleaned, dried, charged, and sealed.

## 2.6.7 Internal Dampers

Dampers shall be parallel blade type with renewable blade seals and be integral to the unitary unit. Damper provisions shall be provided for each outside air intake, exhaust, economizer, and mixing boxes. Dampers shall have automatic modulation and operate as specified.

## 2.6.8 Mixing Boxes

Mixing boxes shall match the base unit in physical size and shall include equally-sized flanged openings, each capable of full air flow. Arrangement shall be as indicated.

## 2.6.9 Cabinet Construction

Casings for the specified unitary equipment shall be constructed of galvanized steel or aluminum sheet metal and galvanized or aluminum

structural members. Minimum thickness of single wall exterior surfaces shall be 18 gauge galvanized steel or 0.071 inch thick aluminum on units with a capacity above 20 tons and 20 gauge galvanized steel or 0.064 inch thick aluminum on units with a capacity less than 20 tons. Casing shall be fitted with lifting provisions, access panels or doors, fan vibration isolators, electrical control panel, corrosion-resistant components, structural support members, insulated condensate drip pan and drain, and internal insulation in the cold section of the casing. Where double-wall insulated construction is proposed, minimum exterior galvanized sheet metal thickness shall be 20 gauge. Provisions to permit replacement of major unit components shall be incorporated. Penetrations of cabinet surfaces, including the floor, shall be sealed. Unit shall be fitted with a drain pan which extends under all areas where water may accumulate. Drain pan shall be fabricated from Type 300 stainless steel, galvanized steel with protective coating as required, or an approved plastic material. Pan insulation shall be water impervious. Extent and effectiveness of the insulation of unit air containment surfaces shall prevent, within limits of the specified insulation, heat transfer between the unit exterior and ambient air, heat transfer between the two conditioned air streams, and condensation on surfaces. Insulation shall conform to ASTM C 1071. Paint and finishes shall comply with the requirements specified in paragraph FACTORY COATING.

#### 2.6.9.1 Indoor Cabinet

Indoor cabinets shall be suitable for the specified indoor service and enclose all unit components.

#### 2.6.9.2 Not Used.

### 2.7 ACCESSORIES

#### 2.7.1 Not Used

#### 2.7.2 Not Used

#### 2.7.3 Not Used

#### 2.7.4 Not Used

#### 2.7.5 Not Used

#### 2.7.6 Not Used

#### 2.7.7 Not Used

#### 2.7.8 Gaskets

Gaskets shall conform to ASTM F 104 - classification for compressed sheet with nitrile binder and acrylic fibers for maximum 700 degrees F service.

#### 2.7.9 Bolts and Nuts

Bolts and nuts shall be in accordance with ASTM A 307. The bolt head shall be marked to identify the manufacturer and the standard with which the bolt complies in accordance with ASTM A 307.

#### 2.7.10 Bird Screen

Screen shall be in accordance with ASTM E 437, Type 1, Class 1, 2 by 2 mesh, 0.063 inch diameter aluminum wire or 0.031 inch diameter stainless steel wire.

## 2.8 FABRICATION

### 2.8.1 Factory Coating

Unless otherwise specified, equipment and component items, when fabricated from ferrous metal, shall be factory finished with the manufacturer's standard finish.

### 2.8.2 Factory Applied Insulation

Refrigeration equipment shall be provided with factory installed insulation on surfaces subject to sweating including the suction line piping. Where motors are the gas-cooled type, factory installed insulation shall be provided on the cold-gas inlet connection to the motor per manufacturer's standard practice. As a minimum, factory insulated items installed indoors shall have a flame spread index no higher than 75 and a smoke developed index no higher than 150. Factory insulated items (no jacket) installed indoors and which are located in air plenums shall have a flame spread index no higher than 25 and a smoke developed index no higher than 50. Flame spread and smoke developed indexes shall be determined by ASTM E 84. Insulation shall be tested in the same density and installed thickness as the material to be used in the actual construction. Material supplied by a manufacturer with a jacket shall be tested as a composite material. Jackets, facings, and adhesives shall have a flame spread index no higher than 25 and a smoke developed index no higher than 50 when tested in accordance with ASTM E 84.

## 2.9 SUPPLEMENTAL COMPONENTS/SERVICES

### 2.9.1 Not Used.

### 2.9.2 Not Used.

### 2.9.3 Not Used

### 2.9.4 Ductwork

Ductwork shall be provided and installed in accordance with Section 15895A AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

### 2.9.5 Temperature Controls

Temperature controls shall be in accordance with Section 15951A DIRECT DIGITAL CONTROLS FOR HVAC.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Work shall be performed in accordance with the manufacturer's published diagrams, recommendations, and equipment warranty requirements. Where equipment is specified to conform to the requirements of ASME BPVC SEC VIII D and ASME BPVC SEC IX, the design, fabrication, and installation of the system shall conform to ASME BPVC SEC VIII D1 and ASME BPVC SEC IX.

### 3.1.1 Equipment

Refrigeration equipment and the installation thereof shall conform to ASHRAE 15. Necessary supports shall be provided for all equipment, appurtenances, and pipe as required, including frames or supports for compressors, pumps, cooling towers, condensers, and similar items. Compressors shall be isolated from the building structure. If mechanical vibration isolators are not provided, vibration absorbing foundations shall be provided. Each foundation shall include isolation units consisting of machine and floor or foundation fastenings, together with intermediate isolation material. Other floor-mounted equipment shall be set on not less than a 6 inch concrete pad doweled in place. Concrete foundations for floor mounted pumps shall have a mass equivalent to three times the weight of the components, pump, base plate, and motor to be supported. In lieu of concrete pad foundation, concrete pedestal block with isolators placed between the pedestal block and the floor may be provided. Concrete pedestal block shall be of mass not less than three times the combined pump, motor, and base weights. Isolators shall be selected and sized based on load-bearing requirements and the lowest frequency of vibration to be isolated. Isolators shall limit vibration to 30 percent at lowest equipment rpm. Lines connected to pumps mounted on pedestal blocks shall be provided with flexible connectors. Foundation drawings, bolt-setting information, and foundation bolts shall be furnished prior to concrete foundation construction for all equipment indicated or required to have concrete foundations. Concrete for foundations shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Equipment shall be properly leveled, aligned, and secured in place in accordance with manufacturer's instructions.

### 3.1.2 Not Used.

### 3.1.3 Field Applied Insulation

Field applied insulation shall be as specified in Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS, except as defined differently herein.

### 3.1.4 Field Painting

Painting required for surfaces not otherwise specified, and finish painting of items only primed at the factory are specified in Section 09900 PAINTING, GENERAL.

## 3.2 CLEANING AND ADJUSTING

Equipment shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. Temporary filters shall be provided for all fans that are operated during construction, and new filters shall be installed after all construction dirt has been removed from the building. System shall be maintained in this clean condition until final acceptance. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension. Control valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or directed. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions. Testing, adjusting, and balancing shall be as specified in Section 15990A TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS.

## 3.3 REFRIGERANT TESTS, CHARGING, AND START-UP

Packaged refrigerant systems which are factory charged shall be checked for refrigerant and oil capacity to verify proper refrigerant levels per manufacturer's recommendations. Following charging, packaged systems shall be tested for leaks with a halide torch or an electronic leak detector.

### 3.3.1 Refrigerant Leakage

If a refrigerant leak is discovered after the system has been charged, the leaking portion of the system shall immediately be isolated from the remainder of the system and the refrigerant pumped into the system receiver or other suitable container. Under no circumstances shall the refrigerant be discharged into the atmosphere.

### 3.3.2 Contractor's Responsibility

The Contractor shall, at all times during the installation and testing of the refrigeration system, take steps to prevent the release of refrigerants into the atmosphere. The steps shall include, but not be limited to, procedures which will minimize the release of refrigerants to the atmosphere and the use of refrigerant recovery devices to remove refrigerant from the system and store the refrigerant for reuse or reclaim.

At no time shall more than 3 ounces of refrigerant be released to the atmosphere in any one occurrence. Any system leaks within the first year shall be repaired in accordance with the requirements herein at no cost to the Government including material, labor, and refrigerant if the leak is the result of defective equipment, material, or installation.

## 3.4 SYSTEM PERFORMANCE TESTS

Before each refrigeration system is accepted, tests to demonstrate the general operating characteristics of all equipment shall be conducted by a registered professional engineer or an approved manufacturer's start-up representative experienced in system start-up and testing, at such times as directed. Tests shall cover a period of not less than 48 hours for each system and shall demonstrate that the entire system is functioning in accordance with the drawings and specifications. Corrections and adjustments shall be made as necessary and tests shall be re-conducted to demonstrate that the entire system is functioning as specified. Prior to acceptance, service valve seal caps and blanks over gauge points shall be installed and tightened. Any refrigerant lost during the system startup shall be replaced. If tests do not demonstrate satisfactory system performance, deficiencies shall be corrected and the system shall be retested. Tests shall be conducted in the presence of the Contracting Officer. Water and electricity required for the tests will be furnished by the Government. Any material, equipment, instruments, and personnel required for the test shall be provided by the Contractor. Field tests shall be coordinated with Section 15990A TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS.

## 3.5 DEMONSTRATIONS

Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total 8 hours of normal working time and start after the system is functionally completed but prior to final acceptance tests. The field posted instructions shall cover all of the items contained in the approved operation and maintenance manuals as well as demonstrations of routine maintenance operations.

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09/99

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## SECTION 15768N

ELECTRIC SPACE HEATING EQUIPMENT  
09/99

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA DC 3 (1989) Residential Controls - Electrical Wall-Mounted Room Thermostats

NEMA ICS 2 (1993) Industrial Control and Systems Controllers, Contactors and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

## UNDERWRITERS LABORATORIES (UL)

UL 1025 (1980; R 1990, Bul. 1991) Electric Air Heaters

UL 1042 (1994; R 1998) Electric Baseboard Heating Equipment

## 1.2 GENERAL REQUIREMENTS

Section 16050N, "Basic Electrical Materials and Methods," applies to this section, with the additions and modifications specified herein.

## 1.3 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

## SD-02 Shop Drawings

Heater installation drawing; G-DO

## SD-03 Product Data

Electric unit heaters; G-DO

Unit thermostat; G-DO

## SD-10 Operation and Maintenance Data

## Electric unit heaters; G-AO

## PART 2 PRODUCTS

## 2.1 ELECTRIC UNIT HEATERS

UL 1025; wattage, voltage, phase, number of steps, Btu/hrand CFM as indicated. Provide control-circuit terminals and single source of power supply. Heaters 5 Kw and larger shall be 3-phase, with load balanced on each of the three phases. Limit leaving air temperature to 140 degrees F with entering air of 60 degrees F.

## 2.1.1 Enclosure

Minimum 20 gage steel.

## 2.1.2 Heating Element

Nickel chromium heating wire element, free from expansion noise and 60 Hz hum. Embed element in magnesium-oxide insulating refractory. Seal element in high-mass steel or corrosion-resisting metallic sheath with fins. Enclose element ends in terminal box. Provide not more than six fins per inch. Limit fin surface temperature 550 degrees F at any point during normal operation.

## 2.1.3 Controls

Include limit controls for overheat protection of heaters. For remote thermostatic operation, provide contactor rated for 100,000 duty cycles. Provide a control transformer to supply 120-volt thermostat control circuit for each heater.

## 2.1.4 Wiring

Completely factory-prewired to terminal strips, ready to receive branch circuit and control connections for 140 degrees Fcopper wiring.

## 2.1.5 Not Used.

## 2.1.6 Thermostat

Provide tamper resistant integral thermostat, adjustable without requiring removal of heater components. Thermostat operating range shall be approximately 50 degrees F to a maximum of 75 degrees F with operating differential of 3 degrees F or less.

## 2.1.7 Disconnect Means

Provide factory-installed safety disconnect switch in combination with thermostat with "off" position marking on the face plate.

## 2.1.8 Not Used

## 2.2 NOT USED

## 2.3 NOT USED

Comply with Section 15760N, "Terminal Heating and Cooling Units."

## 2.4 NOT USED

NEMA DC 3.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Install in conformance with the approved heater installation drawing, NFPA 70, UL listing, and manufacturer's instructions, with necessary clearances for air circulation, maintenance, inspection, service testing and repair. Connect to electrical supply in accordance with Section 16402N, "Interior Distribution System."

#### 3.1.1 Unit Heaters

Mount units plumb, square and level with ceiling and walls.

#### 3.1.2 Not Used.

#### 3.1.3 Not Used.

#### 3.1.4 Not Used.

#### 3.1.5 Not Used.

### 3.2 FIELD QUALITY CONTROL

Provide necessary personnel, instruments, and equipment to perform tests. Notify the Contracting Officer 5 working days prior to scheduled testings and locations.

#### 3.2.1 Field Inspection

Prior to initial operation, inspect installed equipment for conformance with drawings and specifications.

#### 3.2.2 Insulation Resistance Tests

Test 600-volt wiring to verify that no short circuits or grounds exist. Tests shall be made using an instrument which applies a voltage of approximately 500 volts and provides a direct reading of resistance in ohms.

#### 3.2.3 Operational Tests

Test equipment circuits and devices to demonstrate proper operation. Test each item of control equipment not less than 5 times.

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## SECTION 15895A

## AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM

08/02

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 260	(2001) Sound Rating of Ducted Air Moving and Conditioning Equipment
ARI 350	(2000) Sound Rating of Non-Ducted Indoor Air-Conditioning Equipment
ARI 410	(1991) Forced-Circulation Air-Cooling and Air-Heating Coils
ARI 430	(1999) Central-Station Air-Handling Units
ARI 440	(1998) Room Fan-Coils
ARI 445	(1987; R 1993) Room Air-Induction Units
ARI 880	(1998) Air Terminals
ARI Guideline D	(1996) Application and Installation of Central Station Air-Handling Units

## AIR CONDITIONING CONTRACTORS OF AMERICA (ACCA)

ACCA Manual 4	(2001) Installation Techniques for Perimeter Heating & Cooling; 11th Edition
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## AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

AMCA 210	(1999) Laboratory Methods of Testing Fans for Aerodynamic Performance Rating
AMCA 300	(1996) Reverberant Room Method for Sound Testing of Fans

## AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 9	(1990; R 2000) Load Ratings and Fatigue Life for Ball Bearings
ABMA 11	(1990; R 1999) Load Ratings and Fatigue

## Life for Roller Bearings

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI S12.32 (1990; R 2001) Precision Methods for the Determination of Sound Power Levels of Discrete-Frequency and Narrow-Band Noise Sources in Reverberation Rooms

## ASTM INTERNATIONAL (ASTM)

ASTM A 47/A 47M (1999) Ferritic Malleable Iron Castings

ASTM A 53/A 53M (2001) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A 106 (1999e1) Seamless Carbon Steel Pipe for High-Temperature Service

ASTM A 123/A 123M (2001a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 167 (1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

ASTM A 181/A 181M (2001) Carbon Steel Forgings, for General-Purpose Piping

ASTM A 183 (1998) Carbon Steel Track Bolts and Nuts

ASTM A 193/A 193M (2001b) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service

ASTM A 234/A 234M (2001a) Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service

ASTM A 536 (1984; R 1999e1) Ductile Iron Castings

ASTM A 733 (2001) Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples

ASTM A 924/A 924M (1999) General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

ASTM B 62 (1993) Composition Bronze or Ounce Metal Castings

ASTM B 75M (1999) Seamless Copper Tube (Metric)

ASTM B 88 (1999e1) Seamless Copper Water Tube

ASTM B 88M (1999) Seamless Copper Water Tube (Metric)

ASTM B 117 (1997) Operating Salt Spray (Fog) Apparatus

ASTM B 650	(1995) Electrodeposited Engineering Chromium Coatings on Ferrous Substrates
ASTM B 813	(2000) Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
ASTM C 916	(1985; R 1996e1) Adhesives for Duct Thermal Insulation
ASTM C 1071	(2000) Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)
ASTM D 520	(2000) Zinc Dust Pigment
ASTM D 1384	(2001) Corrosion Test for Engine Coolants in Glassware
ASTM D 1654	(1992; R 2000) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 1785	(1999) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2000	(2001) Rubber Products in Automotive Applications
ASTM D 2466	(2001) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2564	(1996a) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2855	(1996) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 3359	(1997) Measuring Adhesion by Tape Test
ASTM E 84	(2001) Surface Burning Characteristics of Building Materials
ASTM E 437	(1992; R 1997) Industrial Wire Cloth and Screens (Square Opening Series)
ASTM F 872	(1984; R 1990) Filter Units, Air-Conditioning: Viscous-Impingement Type, Cleanable
ASTM F 1199	(1988; R 1998) Cast (All Temperature and Pressures) and Welded Pipe Line Strainers (150 psig and 150 degrees F Maximum)
ASTM F 1200	(1988; R 1998) Fabricated (Welded) Pipe Line Strainers (Above 150 psig and 150 degrees F)

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING

## ENGINEERS (ASHRAE)

ASHRAE 15	(2001) Safety Standard for Refrigeration Systems
ASHRAE 52.1	(1992) Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter
ASHRAE 68	(1997) Laboratory Method of Testing to Determine the Sound Power in a Duct
ASHRAE 70	(1991) Method of Testing for Rating the Performance of Air Outlets and Inlets
ASHRAE 84	(1991) Method of Testing Air-to-Air Heat Exchangers

## ASME INTERNATIONAL (ASME)

ASME B1.20.1	(1983; R 2001) Pipe Threads, General Purpose, Inch
ASME B16.3	(1998) Malleable Iron Threaded Fittings
ASME B16.5	(1996) Pipe Flanges and Flanged Fittings
ASME B16.9	(2001) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(2001) Forged Fittings, Socket-Welding and Threaded
ASME B16.18	(2001) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(1995) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	(1988) Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.39	(1998) Malleable Iron Threaded Pipe Unions
ASME B31.1	(2001) Power Piping
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element
ASME BPVC IX	(2001) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

## AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C606 (1997) Grooved and Shouldered Joints  
 AMERICAN WELDING SOCIETY (AWS)

AWS D1.1 (2000) Structural Welding Code - Steel  
 U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-1419 (Rev D; Canc. Notice 1) Filter Element,  
 Air Conditioning (Viscous-Impingement and  
 Dry Types, Replaceable)  
 EXPANSION JOINT MANUFACTURERS ASSOCIATION (EJMA)

EJMA Stds (1998; 7th Edition Addenda 2000) EJMA  
 Standards  
 INSTITUTE OF ENVIRONMENTAL SCIENCES AND TECHNOLOGY (IEST)

IEST RP-CC-001.3 (1997) HEPA and ULPA Filters  
 MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS  
 INDUSTRY (MSS)

MSS SP-25 (1998) Standard Marking System for Valves,  
 Fittings, Flanges and Unions

MSS SP-58 (1993) Pipe Hangers and Supports -  
 Materials, Design and Manufacture

MSS SP-69 (1996) Pipe Hangers and Supports -  
 Selection and Application

MSS SP-70 (1998) Cast Iron Gate Valves, Flanged and  
 Threaded Ends

MSS SP-71 (1997) Gray Iron Swing Check Valves,  
 Flanged and Threaded Ends

MSS SP-72 (1999) Ball Valves with Flanged or  
 Butt-Welding Ends for General Service

MSS SP-80 (1997) Bronze Gate, Globe, Angle and Check  
 Valves

MSS SP-85 (1994) Cast Iron Globe & Angle Valves,  
 Flanged and Threaded Ends

MSS SP-110 (1996) Ball Valves Threaded,  
 Socket-Welding, Solder Joint, Grooved and  
 Flared Ends  
 NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (1998) Motors and Generators  
 NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

NFPA 90A	(1999) Installation of Air Conditioning and Ventilating Systems
NFPA 96	(2001) Ventilation Control and Fire Protection of Commercial Cooking Equipment
NORTH AMERICAN INSULATION MANUFACTURERS ASSOCIATION (NAIMA)	
NAIMA AH115	(2001) Fibrous Glass Duct Construction Standards
SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)	
SMACNA HVAC Duct Const Stds	(1995; Addenda Nov 1997; 6th Printing 2001) HVAC Duct Construction Standards - Metal and Flexible
SMACNA Industry Practice	(1975; 8th Printing 1997) Accepted Industry Practice for Industrial Duct Construction
SMACNA Install Fire Damp HVAC	(1992; 2th Printing 1996) Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems
SMACNA Leakage Test Mnl	(1985; 6th Printing 1997) HVAC Air Duct Leakage Test Manual
UNDERWRITERS LABORATORIES (UL)	
UL 94	(1996; Rev thru May 2001) Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
UL 181	(1996; Rev thru Dec 1998) Factory-Made Air Ducts and Air Connectors
UL 214	(1997; Rev thru Aug 2001) Tests for Flame-Propagation of Fabrics and Films
UL 555	(1999; Rev thru Jan 2002) Fire Dampers
UL 586	(1996; Rev thru Apr 2000) High-Efficiency, Particulate, Air Filter Units
UL 705	(1994; Rev thru Feb 1999) Power Ventilators
UL 723	(1996; Rev thru Sep 2001) Test for Surface Burning Characteristics of Building Materials
UL 900	(1994; Rev thru Oct 1999) Air Filter Units
UL 1995	(1995; Rev thru Aug 1999) Heating and Cooling Equipment
UL Bld Mat Dir	(1999) Building Materials Directory

UL Elec Const Dir (2001) Electrical Construction Equipment Directory

UL Fire Resist Dir (2001) Fire Resistance Directory (2 Vol.)

## 1.2 COORDINATION OF TRADES

Ductwork, piping offsets, fittings, and accessories shall be furnished as required to provide a complete installation and to eliminate interference with other construction.

## 1.3 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, all pipes shall either be capped or plugged until installed.

## 1.4 FIELD MEASUREMENTS

After becoming familiar with all details of the work, the Contractor shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

## 1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Drawings; G-DO  
Installation; G-AO

Drawings showing equipment layout, including assembly and installation details and electrical connection diagrams; ductwork layout showing the location of all supports and hangers, typical hanger details, gauge reinforcement, reinforcement spacing rigidity classification, and static pressure and seal classifications; and piping layout showing the location of all guides and anchors, the load imposed on each support or anchor, and typical support details. Drawings shall include any information required to demonstrate that the system has been coordinated and will properly function as a unit and shall show equipment relationship to other parts of the work, including clearances required for operation and maintenance.

### SD-03 Product Data

Components and Equipment; G-DO

Manufacturer's catalog data included with the detail drawings for the following items. The data shall be highlighted to show model, size, options, etc., that are intended for consideration. Data shall be adequate to demonstrate compliance with contract

requirements for the following:

- a. Piping Components
- b. Ductwork Components
- c. Air Systems Equipment
- d. Air Handling Units
- e. Energy Recovery Devices
- f. Terminal Units

Test Procedures; G-AO

Proposed test procedures for piping hydrostatic test, ductwork leak test, and performance tests of systems, at least 2 weeks prior to the start of related testing.

Welding Procedures; G-AO

A copy of qualified welding procedures, at least 2 weeks prior to the start of welding operations.

Diagrams; G-AO

Proposed diagrams, at least 2 weeks prior to start of related testing. System diagrams that show the layout of equipment, piping, and ductwork, and typed condensed operation manuals explaining preventative maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system shall be framed under glass or laminated plastic. After approval, these items shall be posted where directed.

Manufacturer's Experience; G-AO

Statement demonstrating successful completion of similar services on at least 5 projects of similar size and scope, at least 2 weeks prior to submittal of other items required by this section.

Welded Joints; G-AO

A list of names and identification symbols of qualified welders and welding operators, at least 2 weeks prior to the start of welding operations.

Performance Tests; G-AO

Proposed test schedules for hydrostatic test of piping, ductwork leak test, and performance tests, at least 2 weeks prior to the start of related testing.

Field Training; G-AO

Proposed schedule for field training, at least 2 weeks prior to the start of related training.

## SD-06 Test Reports

Performance Tests; G-AO  
Testing, Adjusting, and Balancing; G-AO

Test reports for the piping hydrostatic test, ductwork leak test, and performance tests in booklet form, upon completion of testing. Reports shall document phases of tests performed including initial test summary, repairs/adjustments made, and final test results.

## SD-07 Certificates

Bolts; G-AO

Written certification from the bolt manufacturer that the bolts furnished comply with the requirements of this specification. The certification shall include illustrations of product markings, and the number of each type of bolt to be furnished.

## SD-10 Operation and Maintenance Data

Operating and Maintenance Instructions; G-AO

Six manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 2 weeks prior to field training. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization submitted shall be capable of providing 4 hour onsite response to a service call on an emergency basis.

## PART 2 PRODUCTS

## 2.1 STANDARD PRODUCTS

Components and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of products that are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years before bid opening. The 2-year manufacturer's experience shall include applications of components and equipment under similar circumstances and of similar size. The 2 years must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. The equipment items shall be supported by a service organization.

## 2.2 ASBESTOS PROHIBITION

Asbestos and asbestos-containing products shall not be used.

### 2.3 NAMEPLATES

Equipment shall have a nameplate installed by the manufacturer that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

### 2.4 EQUIPMENT GUARDS AND ACCESS

Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact shall be fully enclosed or guarded according to OSHA requirements. High temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard shall be properly guarded or covered with insulation of a type specified.

### 2.5 PIPING COMPONENTS

Piping components for water makeup to the heat pump section and condensate drainage from the air handler shall be as specified in Section 15400A PLUMBING, GENERAL PURPOSE.

### 2.6 ELECTRICAL WORK

Electrical motor-driven equipment specified shall be provided complete with motor, motor starter, and controls. Unless otherwise specified, electric equipment, including wiring and motor efficiencies, shall be according to Section 16415A ELECTRICAL WORK, INTERIOR. Electrical characteristics and enclosure type shall be as shown. Unless otherwise indicated, motors of 1 hp and above shall be high efficiency type. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary. Each motor shall be according to NEMA MG 1 and shall be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Manual or automatic control and protective or signal devices required for the operation specified, and any control wiring required for controls and devices, but not shown, shall be provided. Where two-speed or variable-speed motors are indicated, solid-state variable-speed controller may be provided to accomplish the same function. Solid-state variable-speed controllers shall be utilized for motors rated 10 hp or less. Adjustable frequency drives shall be used for larger motors.

### 2.7 CONTROLS

Controls shall be provided as specified in Section 15951A DIRECT DIGITAL CONTROLS FOR HVAC.

### 2.8 DUCTWORK COMPONENTS

#### 2.8.1 Metal Ductwork

All aspects of metal ductwork construction, including all fittings and components, shall comply with SMACNA HVAC Duct Const Stds unless otherwise specified. Elbows shall be radius type with a centerline radius of 1.5 times the width or diameter of the duct where space permits. Otherwise, elbows having a minimum radius equal to the width or diameter of the duct or square elbows with factory fabricated turning vanes may be used. Static pressure 1/2, 1, and 2 inch w.g. ductwork shall meet the requirements of Seal Class C. 3 through 10 inch w. g. shall meet the requirements of Seal Class A. Sealants shall conform to fire hazard classification specified in

Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS and shall be suitable for the range of air distribution and ambient temperatures that it will be exposed to. Pressure sensitive tape shall not be used as a sealant. Spiral lock seam duct, and flat oval shall be made with duct sealant and locked with not less than 3 equally spaced drive screws or other approved methods indicated in SMACNA HVAC Duct Const Stds. The sealant shall be applied to the exposed male part of the fitting collar so that the sealer will be on the inside of the joint and fully protected by the metal of the duct fitting. One brush coat of the sealant shall be applied over the outside of the joint to at least 2 inch band width covering all screw heads and joint gap. Dents in the male portion of the slip fitting collar will not be acceptable. Outdoor air intake ducts and plenums shall be fabricated with watertight soldered or brazed joints and seams.

#### 2.8.1.1 Transitions

Diverging air flow transitions shall be made with each side pitched out a maximum of 15 degrees, for an included angle of 30 degrees. Transitions for converging air flow shall be made with each side pitched in a maximum of 30 degrees, for an included angle of 60 degrees, or shall be as indicated. Factory-fabricated reducing fittings for systems using round duct sections when formed to the shape of the ASME short flow nozzle, need not comply with the maximum angles specified.

#### 2.8.1.2 Metallic Flexible Duct

Metallic type duct shall be single-ply galvanized steel. Duct shall be of corrugated/interlocked, folded and knurled type seam construction, bendable without damage through 180 degrees with a throat radius equal to 0.5 duct diameter. Duct shall conform to UL 181 and shall be rated for positive or negative working pressure of 15 inches water gauge at 350 degrees F when duct is aluminum, and 650 degrees F when duct is galvanized steel or stainless steel.

#### 2.8.1.3 Insulated Nonmetallic Flexible Duct Runouts

Flexible duct runouts shall be used only where indicated. Runout length shall be as shown on the drawings, but shall in no case exceed 10 feet. Runouts shall be preinsulated, factory fabricated, and shall comply with NFPA 90A and UL 181. Either field or factory applied vapor barrier shall be provided. Where coil induction or high velocity units are supplied with vertical air inlets, a streamlined and vaned and mitered elbow transition piece shall be provided for connection to the flexible duct or hose. The last elbow to these units, other than the vertical air inlet type, shall be a die-stamped elbow and not a flexible connector. Insulated flexible connectors may be used as runouts. The insulated material and vapor barrier shall conform to the requirements of Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS. The insulation material surface shall not be exposed to the air stream.

#### 2.8.1.4 General Service Duct Connectors

A flexible duct connector approximately 6 inches in width shall be provided where sheet metal connections are made to fans or where ducts of dissimilar metals are connected. For round/oval ducts, the flexible material shall be secured by stainless steel or zinc-coated, iron clinch-type draw bands. For rectangular ducts, the flexible material locked to metal collars shall be installed using normal duct construction methods. The composite

connector system shall comply with UL 214 and be classified as "flame-retarded fabrics" in UL Bld Mat Dir.

#### 2.8.1.5 Not Used

#### 2.8.2 Fibrous Glass Ductwork

Fibrous glass ductwork may be provided in lieu of sheet metal ductwork only where corrosion resistant ductwork is shown on the drawings. Fibrous glass ductwork, including all components, shall be fabricated according to NAIMA AH115 where the velocity and the static pressure are within its scope. Where the velocity or static pressure exceeds these limits, the ductwork manufacturer shall certify that the ductwork is intended for the velocities and pressures to be encountered, and that the proposed installation meets all performance criteria specified herein for metal ductwork. Fibrous glass ductwork shall have the thermal equivalent of the insulation specified for metal ductwork in Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS. Field or factory fabricated fibrous glass ductwork shall conform to UL 181, Class 1. Duct wall penetrations, transverse joints and longitudinal seams shall be sealed as instructed by the manufacturer by one of the methods prescribed by NAIMA AH115, where applicable, except that pressure sensitive tape shall not be used as a sealant. All items necessary for a complete installation shall be provided as specified for sheet metal duct systems.

#### 2.8.3 Ductwork Accessories

##### 2.8.3.1 Duct Access Doors

Access doors shall be provided in ductwork and plenums where indicated and at all air flow measuring primaries, automatic dampers, fire dampers, coils, thermostats, and other apparatus requiring service and inspection in the duct system, and unless otherwise shown, shall conform to SMACNA HVAC Duct Const Stds. Access doors shall be provided upstream and downstream of air flow measuring primaries and heating and cooling coils. Doors shall be minimum 15 x 18 inches, unless otherwise shown. Where duct size will not accommodate this size door, the doors shall be made as large as practicable. Doors 24 x 24 inches or larger shall be provided with fasteners operable from both sides. Doors in insulated ducts shall be the insulated type.

##### 2.8.3.2 Fire Dampers

Fire dampers shall be 1.5 hour fire rated unless otherwise indicated. Fire dampers shall conform to the requirements of NFPA 90A and UL 555. The Contractor shall perform the fire damper test as outlined in NFPA 90A. A pressure relief damper shall be provided upstream of the fire damper. If the ductwork connected to the fire damper is to be insulated then this pressure relief damper shall be factory insulated. Fire dampers shall be automatic operating type and shall have a dynamic rating suitable for the maximum air velocity and pressure differential to which it will be subjected. Fire dampers shall be approved for the specific application, and shall be installed according to their listing. Fire dampers shall be equipped with a steel sleeve or adequately sized frame installed in such a manner that disruption of the attached ductwork, if any, will not impair the operation of the damper. Sleeves or frames shall be equipped with perimeter mounting angles attached on both sides of the wall or floor opening. Ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce the ceiling of the assemblies shall be

constructed in conformance with UL Fire Resist Dir. Fire dampers shall be curtain type with damper blades out of the air stream. Dampers shall not reduce the duct or the air transfer opening cross-sectional area. Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition or floor slab depth or thickness. Unless otherwise indicated, the installation details given in SMACNA Install Fire Damp HVAC and in manufacturer's instructions for fire dampers shall be followed. Acceptance testing of fire dampers shall be performed per paragraph Fire Damper Acceptance Test and NFPA 90A.

#### 2.8.3.3 Splitters and Manual Balancing Dampers

Splitters and manual balancing dampers shall be furnished with accessible operating mechanisms. Where operators occur in finished portions of the building, operators shall be chromium plated with all exposed edges rounded. Splitters shall be operated by quadrant operators or 3/16 inch rod brought through the side of the duct with locking setscrew and bushing.

Two rods are required on splitters over 8 inches. Manual volume control dampers shall be operated by locking-type quadrant operators. Dampers and splitters shall be 2 gauges heavier than the duct in which installed. Unless otherwise indicated, multileaf dampers shall be opposed blade type with maximum blade width of 12 inches. Access doors or panels shall be provided for all concealed damper operators and locking setscrews. Unless otherwise indicated, the locking-type quadrant operators for dampers, when installed on ducts to be thermally insulated, shall be provided with stand-off mounting brackets, bases, or adapters to provide clearance between the duct surface and the operator not less than the thickness of the insulation. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer. Volume dampers shall be provided where indicated.

#### 2.8.3.4 Air Deflectors and Branch Connections

Air deflectors shall be provided at duct mounted supply outlets, at takeoff or extension collars to supply outlets, at duct branch takeoff connections, and at 90 degree elbows, as well as at locations as indicated on the drawings or otherwise specified. Conical branch connections or 45 degree entry connections may be used in lieu of deflectors or extractors for branch connections. All air deflectors, except those installed in 90 degree elbows, shall be provided with an approved means of adjustment. Adjustment shall be made from easily accessible means inside the duct or from an adjustment with sturdy lock on the face of the duct. When installed on ducts to be thermally insulated, external adjustments shall be provided with stand-off mounting brackets, integral with the adjustment device, to provide clearance between the duct surface and the adjustment device not less than the thickness of the thermal insulation. Air deflectors shall be factory-fabricated units consisting of curved turning vanes or louver blades designed to provide uniform air distribution and change of direction with minimum turbulence or pressure loss. Air deflectors shall be factory or field assembled. Blade air deflectors, also called blade air extractors, shall be approved factory fabricated units consisting of equalizing grid and adjustable blade and lock. Adjustment shall be easily made from the face of the diffuser or by position adjustment and lock external to the duct. Stand-off brackets shall be provided on insulated ducts and are described herein. Fixed air deflectors, also called turning vanes, shall be provided in 90 degree elbows.

#### 2.8.4 Duct Sleeves, Framed Prepared Openings, Closure Collars

#### 2.8.4.1 Duct Sleeves

Duct sleeves shall be provided for round ducts 15 inches in diameter or less passing through floors, walls, ceilings, or roof, and installed during construction of the floor, wall, ceiling, or roof. Round ducts larger than 15 inches in diameter and square, rectangular, and oval ducts passing through floors, walls, ceilings, or roof shall be installed through framed prepared openings. The Contractor shall be responsible for the proper size and location of sleeves and prepared openings. Sleeves and framed openings are also required where grilles, registers, and diffusers are installed at the openings. Framed prepared openings shall be fabricated from 20 gauge galvanized steel, unless otherwise indicated. Where sleeves are installed in bearing walls or partitions, black steel pipe, ASTM A 53/A 53M, Schedule 20 shall be used. Sleeve shall provide 1 inch clearance between the duct and the sleeve or 1 inch clearance between the insulation and the sleeve for insulated ducts.

#### 2.8.4.2 Framed Prepared Openings

Openings shall have 1 inch clearance between the duct and the opening or 1 inch clearance between the insulation and the opening for insulated ducts.

#### 2.8.4.3 Closure Collars

Collars shall be fabricated of galvanized sheet metal not less than 4 inches wide, unless otherwise indicated, and shall be installed on exposed ducts on each side of walls or floors where sleeves or prepared openings are provided. Collars shall be installed tight against surfaces. Collars shall fit snugly around the duct or insulation. Sharp edges of the collar around insulated duct shall be ground smooth to preclude tearing or puncturing the insulation covering or vapor barrier. Collars for round ducts 15 inches in diameter or less shall be fabricated from 20 gauge galvanized steel. Collars for round ducts larger than 15 inches and square, and rectangular ducts shall be fabricated from 18 gauge galvanized steel. Collars shall be installed with fasteners on maximum 6 inch centers, except that not less than 4 fasteners shall be used.

#### 2.8.5 Plenums and Casings for Field-Fabricated Units

##### 2.8.5.1 Plenum and Casings

Plenums and casings shall be fabricated and erected as shown in SMACNA HVAC Duct Const Stds, as applicable. Unless otherwise indicated, system casing shall be constructed of not less than 16 gauge galvanized sheet steel. Cooling coil drain pans with 1 inch threaded outlet shall be provided to collect condensation from the cooling coils. Drain pans shall be fabricated of not lighter than 16 gauge steel, galvanized after fabrication or of 18 gauge corrosion-resisting sheet steel conforming to ASTM A 167, Type 304, welded and stiffened. Drain pans exposed to the atmosphere shall be thermally insulated to prevent condensation. Insulation shall be coated with a flame resistant waterproofing material. Separate drain pans shall be provided for each vertical coil section, and a separate drain line shall be provided for each pan. Pans shall be generously sized to ensure capture of entrained moisture on the downstream-air side of the coil. Openings in the casing, such as for piping connections, shall be sealed and covered to prevent air leakage. Water seal for the drain shall provide at least 2 inch water gauge greater than the maximum negative pressure in the coil space.

#### 2.8.5.2 Casing

Casings shall be terminated at the curb line and anchored by the use of galvanized angle iron sealed and bolted to the curb, as indicated in SMACNA HVAC Duct Const Stds.

#### 2.8.5.3 Access Doors

Access doors shall be provided in each section of the casing. Door frames shall be welded in place, and each door shall be neoprene gasketed, hinged with minimum of two brass hinges, and fastened with a minimum of two brass tension fasteners operable from inside and outside of the casing. Where possible, doors shall be 36 x 18 inches located 18 inches above the floor. Where the space available will not accommodate doors of this size, doors as large as the space will accommodate shall be provided. Doors shall swing so that fan suction or pressure holds door in closed position, and shall be airtight. A push-button station to stop the supply fan shall be located inside the casing where indicated.

#### 2.8.5.4 Factory-Fabricated Insulated Sheet Metal Panels

Factory-fabricated components may be used for field-assembled units, provided all requirements specified for field-fabricated plenums and casings are met. Panels shall be of modular design, pretested for structural strength, thermal control, condensation control, and acoustical control. Panel joints shall be sealed and insulated access doors shall be provided and gasketed to prevent air leakage. Panel construction shall be not less than 20 gauge galvanized sheet steel and shall be assembled with fasteners treated against corrosion. Standard length panels shall deflect not more than 1/2 inch under operation. Details of construction, including joint sealing, not specifically covered shall be as indicated in SMACNA HVAC Duct Const Stds. The plenums and casings shall be constructed to withstand the specified internal pressure of the air systems.

#### 2.8.5.5 Duct Liner

Unless otherwise specified, duct liner shall conform to ASTM C 1071, Type I or II.

#### 2.8.6 Sound Attenuation Equipment

##### a. Acoustical Duct Liner:

Acoustical duct lining shall be fibrous glass designed exclusively for lining ductwork and shall conform to the requirements of ASTM C 1071, Type I and II. Liner composition may be uniform density, graduated density, or dual density, as standard with the manufacturer. Lining shall be coated, not less than 1 inch thick. Where acoustical duct liner is used, liner or combination of liner and insulation applied to the exterior of the ductwork shall be the thermal equivalent of the insulation specified in Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS. Duct sizes shown shall be increased to compensate for the thickness of the lining used. In lieu of sheet metal duct with field-applied acoustical lining, acoustically equivalent lengths of factory fabricated double-walled internally insulated duct with perforated liner may be provided. Net insertion loss value, static pressure drop, and air flow velocity capacity data shall be certified by a nationally recognized independent acoustical laboratory.

### 2.8.7 Diffusers, Registers, and Grilles

Units shall be factory-fabricated of steel, corrosion-resistant steel, or aluminum and shall distribute the specified quantity of air evenly over space intended without causing noticeable drafts, air movement faster than 50 fpm in occupied zone, or dead spots anywhere in the conditioned area. Outlets for diffusion, spread, throw, and noise level shall be as required for specified performance. Performance shall be certified according to ASHRAE 70. Inlets and outlets shall be sound rated and certified according to ASHRAE 70. Sound power level shall be as indicated. Diffusers and registers shall be provided with volume damper with accessible operator, unless otherwise indicated; or if standard with the manufacturer, an automatically controlled device will be acceptable. Volume dampers shall be opposed blade type for all diffusers and registers, except linear slot diffusers. Linear slot diffusers shall be provided with round or elliptical balancing dampers. Where the inlet and outlet openings are located less than 7 feet above the floor, they shall be protected by a grille or screen according to NFPA 90A.

#### 2.8.7.1 Diffusers

Diffuser types shall be as indicated. Ceiling mounted units shall be furnished with anti-smudge devices, unless the diffuser unit minimizes ceiling smudging through design features. Diffusers shall be provided with air deflectors of the type indicated. Air handling troffers or combination light and ceiling diffusers shall conform to the requirements of UL Elec Const Dir for the interchangeable use as cooled or heated air supply diffusers or return air units. Ceiling mounted units shall be installed with rims tight against ceiling. Sponge rubber gaskets shall be provided between ceiling and surface mounted diffusers for air leakage control. Suitable trim shall be provided for flush mounted diffusers. Duct collar connecting the duct to diffuser shall be airtight and shall not interfere with volume controller. Return or exhaust units shall be similar to supply diffusers.

#### 2.8.7.2 Registers and Grilles

Units shall be four-way directional-control type, except that return and exhaust registers may be fixed horizontal or vertical louver type similar in appearance to the supply register face. Registers shall be provided with sponge-rubber gasket between flanges and wall or ceiling. Wall supply registers shall be installed at least 6 inches below the ceiling unless otherwise indicated. Return and exhaust registers shall be located 6 inches above the floor unless otherwise indicated. Four-way directional control may be achieved by a grille face which can be rotated in 4 positions or by adjustment of horizontal and vertical vanes. Grilles shall be as specified for registers, without volume control damper.

#### 2.8.8 Louvers

Louvers for installation in exterior walls which are associated with the air supply and distribution system shall be as specified in Section 07600A SHEET METALWORK, GENERAL.

#### 2.8.9 Air Vents and Goosenecks

Air vents and goosenecks shall be fabricated from galvanized steel or aluminum sheets with galvanized or aluminum structural shapes. Sheet metal thickness, reinforcement, and fabrication shall conform to SMACNA HVAC Duct

Const Stds. Louver blades shall be accurately fitted and secured to frames. Edges of louver blades shall be folded or beaded for rigidity and baffled to exclude driving rain. Air vents, and goosenecks shall be provided with bird screen.

#### 2.8.10 Bird Screens and Frames

Bird screens shall conform to ASTM E 437, No. 2 mesh, aluminum or stainless steel. Aluminum screens shall be rated "medium-light". Stainless steel screens shall be rated "light". Frames shall be removable type, or stainless steel or extruded aluminum.

#### 2.8.11 Not Used.

### 2.9 AIR SYSTEMS EQUIPMENT

#### 2.9.1 Fans

Fans shall be tested and rated according to AMCA 210. Fans may be connected to the motors either directly or indirectly with V-belt drive. V-belt drives shall be designed for not less than 150 percent of the connected driving capacity. Motor sheaves shall be variable pitch for 15 hp and below and fixed pitch as defined by ARI Guideline D. Variable pitch sheaves shall be selected to drive the fan at a speed which will produce the specified capacity when set at the approximate midpoint of the sheave adjustment. When fixed pitch sheaves are furnished, a replaceable sheave shall be provided when needed to achieve system air balance. Motors for V-belt drives shall be provided with adjustable rails or bases. Removable metal guards shall be provided for all exposed V-belt drives, and speed-test openings shall be provided at the center of all rotating shafts.

Fans shall be provided with personnel screens or guards on both suction and supply ends, except that the screens need not be provided, unless otherwise indicated, where ducts are connected to the fan. Fan and motor assemblies shall be provided with vibration-isolation supports or mountings as indicated. Vibration-isolation units shall be standard products with published loading ratings. Each fan shall be selected to produce the capacity required at the fan static pressure indicated. Sound power level shall be as indicated. The sound power level values shall be obtained according to AMCA 300. Standard AMCA arrangement, rotation, and discharge shall be as indicated.

##### 2.9.1.1 Centrifugal Fans

Centrifugal fans shall be fully enclosed, single-width single-inlet, or double-width double-inlet, AMCA Pressure Class I, II, or III as required or indicated for the design system pressure. Impeller wheels shall be rigidly constructed, accurately balanced both statically and dynamically. Fan wheels over 36 inches in diameter shall have overhung pulleys and a bearing on each side of the wheel. Fan wheels 36 inches or less in diameter may have one or more extra long bearings between the fan wheel and the drive. Bearings shall be sleeve type, self-aligning and self-oiling with oil reservoirs, or precision self-aligning roller or ball-type with accessible grease fittings or permanently lubricated type. Grease fittings shall be connected to tubing and serviceable from a single accessible point. Bearing life shall be L50 rated at not less than 200,000 hours as defined by ABMA 9 and ABMA 11. Fan shafts shall be steel, accurately finished, and shall be provided with key seats and keys for impeller hubs and fan pulleys. Each fan outlet shall be of ample proportions and shall be designed for the attachment of angles and bolts for attaching flexible

connections. Automatically operated inlet vanes shall be provided on suction inlets. Automatically operated outlet dampers shall be provided. Motors, unless otherwise indicated, shall not exceed 1800 rpm and shall have dripproof enclosures. Motor starter type shall be specified in section 16415A ELECTRICAL WORK INTERIOR

#### 2.9.1.2 In-Line Centrifugal Fans

In-line fans shall have centrifugal backward inclined blades, stationary discharge conversion vanes, internal and external belt guards, and adjustable motor mounts. Fans shall be mounted in a welded tubular casing.

Air shall enter and leave the fan axially. Inlets shall be streamlined with conversion vanes to eliminate turbulence and provide smooth discharge air flow. Fan bearings and drive shafts shall be enclosed and isolated from the air stream. Fan bearings shall be sealed against dust and dirt and shall be permanently lubricated, and shall be precision self aligning ball or roller type. Bearing life shall be L50 rated at not less than 200,000 hours as defined by ABMA 9 and ABMA 11. Motors shall have dripproof enclosure.

#### 2.9.1.3 Not Used

#### 2.9.1.4 Panel Type Power Wall Ventilators

Fans shall be propeller type, assembled on a reinforced metal panel with venturi opening spun into panel. Fans with wheels less than 24 inches in diameter shall be direct or V-belt driven and fans with wheels 24 inches diameter and larger shall be V-belt drive type. Fans shall be furnished with wall mounting collar. Lubricated bearings shall be provided. Fans shall be fitted with wheel and motor side metal or wire guards which have a corrosion-resistant finish. Motor enclosure shall be dripproof type. Motor operated backdraft dampers shall be provided where indicated.

#### 2.9.1.5 Centrifugal Type Power Wall Ventilators

Fans shall be V-belt driven centrifugal type with backward inclined, non-overloading wheel. Motor housing shall be removable and weatherproof. Unit housing shall be designed for sealing to building surface and for discharge and condensate drippage away from building surface. Housing shall be constructed of heavy gauge aluminum. Unit shall be fitted with an aluminum or plated steel wire discharge bird screen, an airtight and liquid-tight metallic wall sleeve. Motor enclosure shall be dripproof type. Lubricated bearings shall be provided.

#### 2.9.1.6 Not Used

#### 2.9.1.7 Not Used

#### 2.9.1.8 Kitchen Exhaust Hood Fans

Kitchen exhaust hoods and associated fans shall be integral to the undercabinet microwave units as specified in Section 11401N KITCHEN AND LAUNDRY EQUIPMENT.

#### 2.9.1.9 Ceiling Exhaust Fans

Suspended cabinet-type ceiling exhaust fans shall be centrifugal type, direct-driven. Fans shall have acoustically insulated housing. Integral backdraft damper shall be chatter-proof. The integral face grille shall be

of egg-crate design or louver design. Fan motors shall be mounted on vibration isolators. Unit shall be provided with mounting flange for hanging unit from above. Fans shall be U.L. listed.

#### 2.9.2 Coils

Coils for the air handler shall be as specified in Section 15700A UNITARY HEATING AND COOLING EQUIPMENT.

#### 2.9.3 Air Filters

Air filters shall be as specified in Section 15700A UNITARY HEATING AND COOLING EQUIPMENT.

### 2.10 AIR HANDLING UNITS

Air handling units shall be as specified for packaged water source heat pump units as specified in Section 15700A UNITARY HEATING AND COOLING EQUIPMENT.

#### 2.11 TERMINAL UNITS

##### 2.11.1 Not Used

##### 2.11.2 Not Used

##### 2.11.3 Variable Volume Bypass Boxes

VAV by-pass boxes shall be the type, size, and capacity shown on the drawings and shall be mounted in the ceiling and shall be suitable for single duct system applications. Actuators and controls shall be as specified in CONTROLS. Unit enclosures shall be constructed of galvanized steel not lighter than 22 gauge or aluminum sheet not lighter than 18 gauge.

Single or multiple discharge outlets shall be provided as required. Units with flow limiters are not acceptable. Unit air volume shall be factory preset and readily field adjustable without special tools. A flow chart shall be attached to each unit. Acoustic performance of the terminal units shall be based upon units tested according to ARI 880. Sound power level shall be as indicated. Discharge sound power shall be shown for minimum and 1-1/2 inches water gauge inlet static pressure. Acoustical lining shall be according to NFPA 90A.

##### 2.11.3.1 Not Used.

##### 2.11.3.2 Variable Volume, Single Duct

Variable volume, single duct, terminal units shall be provided with a calibrated air volume sensing device, air valve or damper, actuator, and accessory relays. Units shall control air volume to within plus or minus 5 percent of each air set point volume as determined by the thermostat with variations in inlet pressures from 3/4 to 6 inch water gauge. Internal resistance of units shall not exceed 0.4 inch water gauge at maximum flow range. Unit volume controller shall be normally open upon loss of power.

##### 2.11.3.3 Not Used.

##### 2.11.3.4 Not Used.

##### 2.11.3.5 Not Used.

2.11.3.6 Not Used.

2.11.4 Not Used

2.12 NOT USED.

2.13 FACTORY PAINTING

Units which are not of galvanized construction according to ASTM A 123/A 123M or ASTM A 924/A 924M shall be factory painted with a corrosion resisting paint finish. Internal and external ferrous metal surfaces shall be cleaned, phosphatized and coated with a paint finish which has been tested according to ASTM B 117, ASTM D 1654, and ASTM D 3359. Evidence of satisfactory paint performance for a minimum of 125 hours for units to be installed indoors and 500 hours for units to be installed outdoors shall be submitted. Rating of failure at the scribe mark shall be not less than 6, average creepage not greater than 1/8 inch. Rating of the inscribed area shall not be less than 10, no failure. On units constructed of galvanized steel which have been welded, exterior surfaces of welds or welds that have burned through from the interior shall receive a final shop docket of zinc-rich protective paint according to ASTM D 520 Type I.

PART 3 EXECUTION

3.1 INSTALLATION

Work shall be installed as shown and according to the manufacturer's diagrams and recommendations.

3.1.1 Not Used.

3.1.2 Not Used.

3.1.2.1 Not Used.

3.1.3 Not Used.

3.1.4 Not Used.

3.1.5 Condensate Drain Lines

Water seals shall be provided in the condensate drain from all units. The depth of each seal shall be 2 inches plus the number of inches, measured in water gauge, of the total static pressure rating of the unit to which the drain is connected. Water seals shall be constructed of 2 tees and an appropriate U-bend with the open end of each tee plugged. Pipe cap or plug cleanouts shall be provided where indicated. Drains indicated to connect to the sanitary waste system shall be connected by an indirect waste fitting. Air conditioner drain lines shall be insulated as specified in Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS. Condensate drain piping materials shall be as specified in Section 15400A PLUMBING, GENERAL PURPOSE.

3.1.6 Not Used.

3.1.7 Not Used.

3.1.8 Not Used.

### 3.1.9 Equipment and Installation

Frames and supports shall be provided for tanks, compressors, pumps, valves, air handling units, fans, coils, dampers, and other similar items requiring supports. Air handling units shall be floor mounted or ceiling hung, as indicated. The method of anchoring and fastening shall be as detailed. Floor-mounted equipment, unless otherwise indicated, shall be set on not less than 6 inch concrete pads or curbs doweled in place. Concrete foundations for circulating pumps shall be heavy enough to minimize the intensity of the vibrations transmitted to the piping and the surrounding structure, as recommended in writing by the pump manufacturer. In lieu of a concrete pad foundation, a concrete pedestal block with isolators placed between the pedestal block and the floor may be provided. The concrete foundation or concrete pedestal block shall be of a mass not less than three times the weight of the components to be supported. Lines connected to the pump mounted on pedestal blocks shall be provided with flexible connectors. Foundation drawings, bolt-setting information, and foundation bolts shall be furnished prior to concrete foundation construction for all equipment indicated or required to have concrete foundations. Concrete for foundations shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

### 3.1.10 Access Panels

Access panels shall be provided for concealed valves, vents, controls, dampers, and items requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced and maintained or completely removed and replaced. Access panels shall be as specified in Section 05500A MISCELLANEOUS METALS.

### 3.1.11 Flexible Connectors

Pre-insulated flexible connectors and flexible duct shall be attached to other components in accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint. Hangers, when required to suspend the connectors, shall be of the type recommended by the connector or duct manufacturer and shall be provided at the intervals recommended.

### 3.1.12 Sleeved and Framed Openings

Space between the sleeved or framed opening and the duct or the duct insulation shall be packed as specified in Section 07840A FIRESTOPPING for fire rated penetrations. For non-fire rated penetrations, the space shall be packed as specified in Section 07900A JOINT SEALING.

### 3.1.13 Metal Ductwork

Installation shall be according to SMACNA HVAC Duct Const Stds unless otherwise indicated. Duct supports for sheet metal ductwork shall be according to SMACNA HVAC Duct Const Stds, unless otherwise specified. Friction beam clamps indicated in SMACNA HVAC Duct Const Stds shall not be used. Risers on high velocity ducts shall be anchored in the center of the vertical run to allow ends of riser to move due to thermal expansion. Supports on the risers shall allow free vertical movement of the duct. Supports shall be attached only to structural framing members and concrete slabs. Supports shall not be anchored to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking. Where supports are required between structural framing members, suitable intermediate metal framing shall be provided. Where C-clamps are

used, retainer clips shall be provided.

3.1.13.1 Not Used

3.1.13.2 Not Used.

3.1.13.3 Not Used

3.1.14 Not Used

3.1.15 FRP Ductwork

Fibrous glass reinforced plastic ducting and related structures shall conform to SMACNA Industry Practice. Flanged joints shall be provided where indicated. Crevice-free butt lay-up joints are acceptable where flanged joints are not indicated. When ambient temperatures are lower than 50 degrees F, joints shall be heat cured by exothermic reaction heat packs.

3.1.16 Kitchen Exhaust Ductwork

3.1.16.1 Ducts Conveying Smoke and Grease Laden Vapors

Ducts conveying smoke and grease laden vapors shall conform to requirements of NFPA 96. Seams, joints, penetrations, and duct-to-hood collar connections shall have a liquid tight continuous external weld. Duct material shall be minimum 16 gauge carbon steel.

3.1.17 Acoustical Duct Lining

Lining shall be applied in cut-to-size pieces attached to the interior of the duct with nonflammable fire resistant adhesive conforming to ASTM C 916, Type I, NFPA 90A, UL 723, and ASTM E 84. Top and bottom pieces shall lap the side pieces and shall be secured with welded pins, adhered clips of metal, nylon, or high impact plastic, and speed washers or welding cup-head pins installed according to SMACNA HVAC Duct Const Stds. Welded pins, cup-head pins, or adhered clips shall not distort the duct, burn through, nor mar the finish or the surface of the duct. Pins and washers shall be flush with the surfaces of the duct liner and all breaks and punctures of the duct liner coating shall be sealed with the nonflammable, fire resistant adhesive. Exposed edges of the liner at the duct ends and at other joints where the lining will be subject to erosion shall be coated with a heavy brush coat of the nonflammable, fire resistant adhesive, to prevent delamination of glass fibers. Duct liner may be applied to flat sheet metal prior to forming duct through the sheet metal brake. Lining at the top and bottom surfaces of the duct shall be additionally secured by welded pins or adhered clips as specified for cut-to-size pieces. Other methods indicated in SMACNA HVAC Duct Const Stds to obtain proper installation of duct liners in sheet metal ducts, including adhesives and fasteners, will be acceptable.

3.1.18 Dust Control

To prevent the accumulation of dust, debris and foreign material during construction, temporary dust control protection shall be provided. The distribution system (supply and return) shall be protected with temporary seal-offs at all inlets and outlets at the end of each day's work. Temporary protection shall remain in place until system is ready for startup.

### 3.1.19 Insulation

Thickness and application of insulation materials for ductwork, piping, and equipment shall be according to Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS. Outdoor air intake ducts and plenums shall be externally insulated up to the point where the outdoor air mixes with the return air stream.

### 3.1.20 Duct Test Holes

Holes with closures or threaded holes with plugs shall be provided in ducts and plenums as indicated or where necessary for the use of pitot tube in balancing the air system. Extensions, complete with cap or plug, shall be provided where the ducts are insulated.

### 3.1.21 Not Used.

### 3.1.22 Power Transmission Components Adjustment

V-belts and sheaves shall be tested for proper alignment and tension prior to operation and after 72 hours of operation at final speed. Belts on drive side shall be uniformly loaded, not bouncing. Alignment of direct driven couplings shall be to within 50 percent of manufacturer's maximum allowable range of misalignment.

## 3.2 FIELD PAINTING AND IDENTIFICATION SYSTEMS

### 3.2.1 Identification Tags

Identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and item number shall be installed on all valves and dampers. Tags shall be 1-3/8 inch minimum diameter and marking shall be stamped or engraved. Indentations shall be black for reading clarity. Tags shall be attached to valves with No. 12 AWG, copper wire, chrome-plated beaded chain or plastic straps designed for that purpose.

### 3.2.2 Finish Painting and Pipe Color Code Marking

Finish painting of items only primed at the factory, surfaces not specifically noted otherwise, and color code marking for piping shall be as specified in Section 09900 PAINTS AND COATINGS.

### 3.2.3 Color Coding Scheme for Locating Hidden Utility Components

Scheme shall be provided in buildings having suspended grid ceilings. The color coding scheme shall identify points of access for maintenance and operation of components and equipment that are not visible from the finished space and are accessible from the ceiling grid. The color coding scheme shall consist of a color code board and colored metal disks. Each colored metal disk shall be approximately 3/8 inch diameter and secured to removable ceiling panels with fasteners. Each fastener shall be inserted into the ceiling panel so as to be concealed from view. The fasteners shall be manually removable without the use of tools and shall not separate from the ceiling panels when the panels are dropped from ceiling height. Installation of colored metal disks shall follow completion of the finished surface on which the disks are to be fastened. The color code board shall be approximately 3 foot wide, 30 inches high, and 1/2 inches thick. The board shall be made of wood fiberboard and framed under glass or 1/16 inch transparent plastic cover. The color code symbols shall be approximately

3/4 inch in diameter and the related lettering in 1/2 inch high capital letters. The color code board shall be mounted in the mechanical or equipment room. The color code system shall be indicated on Section 09915 COLOR SCHEDULE

3.3 NOT USED.

3.4 Not Used

3.5 DAMPER ACCEPTANCE TEST

All fire dampers and smoke dampers shall be operated under normal operating conditions, prior to the occupancy of a building to determine that they function properly. Fire dampers equipped with fusible links shall be tested by having the fusible link cut in place. Dynamic fire dampers shall be tested with the air handling and distribution system running. All fire dampers shall be reset with the fusible links replaced after acceptance testing. To ensure optimum operation and performance, the damper must be installed so it is square and free from racking.

3.6 TESTING, ADJUSTING, AND BALANCING

Testing, adjusting, and balancing shall be as specified in Section 15990A TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS. Testing, adjusting, and balancing shall begin only when the air supply and distribution, including controls, has been completed, with the exception of performance tests.

3.7 PERFORMANCE TESTS

After testing, adjusting, and balancing has been completed as specified, each system shall be tested as a whole to see that all items perform as integral parts of the system and temperatures and conditions are evenly controlled throughout the building. Corrections and adjustments shall be made as necessary to produce the conditions indicated or specified. Capacity tests and general operating tests shall be conducted by an experienced engineer. Tests shall cover a period of not less than 7 days for each system and shall demonstrate that the entire system is functioning according to the specifications. Coincidental chart recordings shall be made at points indicated on the drawings for the duration of the time period and shall record the temperature at space thermostats or space sensors, the humidity at space humidistats or space sensors and the ambient temperature and humidity in a shaded and weather protected area.

3.8 CLEANING AND ADJUSTING

Pipes shall be cleaned free of scale and thoroughly flushed of foreign matter. A temporary bypass shall be provided for water coils to prevent flushing water from passing through coils. Strainers and valves shall be thoroughly cleaned. Prior to testing and balancing, air shall be removed from water systems by operating the air vents. Temporary measures, such as piping the overflow from vents to a collecting vessel shall be taken to avoid water damage during the venting process. Air vents shall be plugged or capped after the system has been vented. Inside of Heat Pump, and Bypass box units ducts, plenums, and casing shall be thoroughly cleaned of debris and blown free of small particles of rubbish and dust and then shall be vacuum cleaned before installing outlet faces. Equipment shall be wiped clean, with traces of oil, dust, dirt, or paint spots removed. Temporary filters shall be provided prior to startup of all fans that are operated during construction, and new filters shall be installed after all

construction dirt has been removed from the building, and the ducts, plenums, casings, and other items specified have been vacuum cleaned. System shall be maintained in this clean condition until final acceptance. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension. Control valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or directed. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

### 3.9 FIELD TRAINING

The Contractor shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of 8 hours of normal working time and shall start after the system is functionally complete but prior to the performance tests. The field instruction shall cover all of the items contained in the approved Operating and Maintenance Instructions.

-- End of Section --

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SECTION 15951A

DIRECT DIGITAL CONTROL FOR HVAC

12/01

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## SECTION 15951A

DIRECT DIGITAL CONTROL FOR HVAC  
12/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

AMCA 500 (11989; Rev994) Test Methods for Louvers, Dampers and Shutters

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.1 (1995) Code for Electricity Metering

## ASME INTERNATIONAL (ASME)

ASME B40.1 (1991) Gauges - Pressure Indicating Dial Type - Elastic Element

## ELECTRONIC INDUSTRIES ALLIANCE (EIA)

EIA ANSI/EIA/TIA-232-F (1991) Interface Between Data Technical Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange

## INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41 (1991; R 1995) Surge Voltages in Low-Voltage AC Power Circuits

IEEE Std 142 (1991) IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (1991) Enclosures for Electrical Equipment (1000 Volts Maximum)

NEMA ICS 1 (1993) Industrial Control and Systems

NEMA ST 1 (1988) Specialty Transformers (Except General-Purpose Type)

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

NFPA 90A (1996) Installation of Air Conditioning and Ventilating Systems

UNDERWRITERS LABORATORIES (UL)

UL 268A (1998) Smoke Detectors for Duct Application

UL 508 (1993; Rev thru Oct 1997) Industrial Control Equipment

## 1.2 GENERAL REQUIREMENTS

The direct digital control (DDC) shall be a complete system suitable for the heating, ventilating and air-conditioning (HVAC) system.

### 1.2.1 Nameplates, Lens Caps, and Tags

Nameplates and lens caps bearing legends as shown and tags bearing device-unique identifiers as shown shall have engraved or stamped characters. A plastic or metal tag shall be mechanically attached directly to each device or attached by a metal chain or wire.

### 1.2.2 Verification of Dimensions

After becoming familiar with all details of the work, the Contractor shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

### 1.2.3 Drawings

Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. The Contractor shall carefully investigate the mechanical, electrical, and finish conditions that could affect the work to be performed, shall arrange such work accordingly, and shall furnish all work necessary to meet such conditions.

### 1.2.4 Power-Line Surge Protection

Equipment connected to ac circuits shall be protected from power-line surges. Equipment protection shall meet the requirements of IEEE C62.41. Fuses shall not be used for surge protection.

### 1.2.5 Surge Protection for Transmitter and Control Wiring

DDC system control-panel equipment shall be protected against surges induced on control and transmitter wiring installed outside and as shown. The equipment protection shall be tested in the normal mode and in the common mode, using the following two waveforms:

a. A 10-microsecond by 1,000-microsecond waveform with a peak voltage of 1,500 volts and a peak current of 60 amperes.

b. An eight microsecond by 20-microsecond waveform with a peak voltage of 1,000 volts and a peak current of 500 amperes.

### 1.2.6 System Overall Reliability Requirement

The system shall be configured and installed to yield a mean time between failure (MTBF) of at least 40,000 hours. Each DDC controller shall be designed, configured, installed and programmed to provide for stand alone operation with minimal performance degradation on failure of other system components to which it is connected or with which it communicates.

#### 1.2.7 DDC System Network Accessibility

Where the systems to be controlled by the DDC system are located in multiple mechanical rooms, each mechanical room shall have at least one communication port for the portable workstation/tester. DDC controllers shall be located in the same room as the equipment being controlled or in an adjacent space which has direct access to the equipment room.

#### 1.2.8 System Accuracy and Display

The system shall maintain an end-to-end accuracy for one year from sensor to operator's console display for the applications specified and shall display the value as specified. Each temperature shall be displayed and printed to nearest 0.1 degree F.

##### 1.2.8.1 Space Temperature

Space temperature with a range of 50 to 85 degrees F plus or minus 0.75 degree F for conditioned space; 30 to 130 degrees F plus or minus 1 degree F for unconditioned space.

##### 1.2.8.2 Duct Temperature

Duct temperature with a range of 40 to 140 degrees F plus or minus 2 degrees F.

##### 1.2.8.3 Outside Air Temperature

Outside air (OA) temperature with a range of minus 30 to plus 130 degrees F plus or minus 2 degrees F; with a subrange of 30 to 100 degrees F plus or minus 1 degree F.

##### 1.2.8.4 Water Temperature

Water temperature with a range of 30 to 100 degrees F plus or minus 0.75 degree F; the range of 100 to 250 degrees F plus or minus 2 degrees F; and water temperatures for the purpose of performing Btu calculations using differential temperatures to plus or minus 0.5 degree F using matched sensors.

##### 1.2.8.5 High Temperature

High temperature with a range of 200 to 500 degrees F plus or minus 2.0 degrees F.

##### 1.2.8.6 Relative Humidity

Relative humidity, within a range of 20 to 80 percent, plus or minus 6.0 percent of range (display and print to nearest 1.0 percent).

##### 1.2.8.7 Pressure

Pressure with a range for the specific application plus or minus 2.0 percent of range (display and print to nearest psi.)

#### 1.2.8.8 Flow

Flow with a range for the specific application plus or minus 3.0 percent of range, and flows for the purpose of thermal calculations to plus or minus 2.0 percent of actual flow (display and print to nearest unit, such as gallons per minute).

#### 1.2.8.9 KWh and kW Demand

KWh and kW demand with a range for the specific application plus or minus 1.0 percent of reading (display and print to nearest kWh or kW).

#### 1.2.8.10 Analog Value Input

An analog value input to the system's equipment via an AI with a maximum error of 0.50 percent of range, not including the sensor or transmitter error. This accuracy shall be maintained over the specified environmental conditions.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

##### HVAC Control System; G-DO

Drawings shall be on 34 by 22 inch sheets in the form and arrangement shown. The drawings shall use the same abbreviations, symbols, nomenclature and identifiers shown. Each control system element on a drawing shall have a unique identifier as shown. The HVAC Control System Drawings shall be delivered together as a complete submittal. Deviations must be approved by the Contracting Officer. Drawings shall be submitted along with Submittal SD-01, Data.

#### a. HVAC Control System Drawings shall include the following:

Sheet One: Drawing Index, HVAC Control System Legend.

Sheet Two: Valve Schedule, Damper Schedule.

Sheet Three: Not Used.

Sheet Four: Control System Schematic and Equipment Schedule.

Sheet Five: Sequence of Operation and Data Terminal Strip Layout.

Sheet Six: Control Loop Wiring Diagrams.

Sheet Seven: Motor Starter and Relay Wiring Diagram.

Sheet Eight: Communication Network and Block Diagram.

Sheet Nine: DDC Panel Installation and Block Diagram.

b. The HVAC Control System Drawing Index shall show the name and number of the building, military site, State or other similar designation, and Country. The Drawing Index shall list HVAC Control System Drawings, including the drawing number, sheet number, drawing title, and computer filename when used. The HVAC Control System Legend shall show generic symbols and the name of devices shown on the HVAC Control System Drawings.

c. The valve schedule shall include each valve's unique identifier, size, flow coefficient Cv, pressure drop at specified flow rate, spring range, positive positioner range, actuator size, close-off pressure data, dimensions, and access and clearance requirements data. Valve schedules may be submitted in advance but shall be included in the complete submittal.

d. The damper schedule shall contain each damper's and each actuator's identifier, nominal and actual sizes, orientation of axis and frame, direction of blade rotation, spring ranges, operation rate, positive positioner ranges, locations of actuators and damper end switches, arrangement of sections in multi-section dampers, and methods of connecting dampers, actuators, and linkages. The Damper Schedule shall include the maximum leakage rate at the operating static-pressure differential. The Damper Schedule shall contain actuator selection data supported by calculations of the torque required to move and seal the dampers, access and clearance requirements. Damper schedules may be submitted in advance but shall be included in the complete submittal.

e. Not Used.

f. The HVAC control system schematics shall be in the form shown, and shall show all control and mechanical devices associated with the HVAC system. A system schematic drawing shall be submitted for each HVAC system.

g. The HVAC control system equipment Schedule shall be in the form shown. All devices shown on the drawings having unique identifiers shall be referenced in the equipment schedule. Information to be included in the equipment schedule shall be the control loop, device unique identifier, device function, setpoint, input range, and additional important parameters (i.e., output range). An equipment schedule shall be submitted for each HVAC system.

h. The HVAC control system sequence of operation shall reflect the language and format of this specification, and shall refer to the devices by their unique identifiers as shown. No operational deviations from specified sequences will be permitted without prior written approval of the Contracting Officer. Sequences of operation shall be submitted for each HVAC control system including each type of terminal unit control system.

i. The HVAC control system wiring diagrams shall be functional

wiring diagrams which show the interconnection of conductors and cables to HVAC control panel terminal blocks and to the identified terminals of devices, starters and package equipment. The wiring diagrams shall show necessary jumpers and ground connections. The wiring diagrams shall show the labels of all conductors. Sources of power required for HVAC control systems and for packaged equipment control systems shall be identified back to the panel board circuit breaker number, HVAC system control panel, magnetic starter, or packaged equipment control circuit. Each power supply and transformer not integral to a controller, starter, or packaged equipment shall be shown. The connected volt-ampere load and the power supply volt-ampere rating shall be shown. Wiring diagrams shall be submitted for each HVAC control system.

#### SD-03 Product Data

##### Service Organizations; G-AO

Six copies of a list of service organizations qualified to service the HVAC control system. The list shall include the service organization name, address, technical point of contact and telephone number, and contractual point of contact and telephone number.

##### Equipment Compliance Booklet; G-DO

The HVAC Control System Equipment Compliance Booklet (ECB) shall be in booklet form and indexed, with numbered tabs separating the information on each device. It shall consist of, but not be limited to, data sheets and catalog cuts which document compliance of all devices and components with the specifications. The ECB shall be indexed in alphabetical order by the unique identifiers. Devices and components which do not have unique identifiers shall follow the devices and components with unique identifiers and shall be indexed in alphabetical order according to their functional name. The ECB shall include a Bill of Materials for each HVAC Control System. The Bill of Materials shall function as the Table of Contents for the ECB and shall include the device's unique identifier, device function, manufacturer, model/part/catalog number used for ordering, and tab number where the device information is located in the ECB. The ECB shall be submitted along with Submittal SD-04, Drawings.

##### Commissioning Procedures; G-AO

Six copies of the HVAC control system commissioning procedures, in booklet form and indexed, 60 days prior to the scheduled start of commissioning. Commissioning procedures shall be provided for each HVAC control system, and for each type of terminal unit control system. The Commissioning procedures shall reflect the format and language of this specification, and refer to devices by their unique identifiers as shown. The Commissioning procedures shall be specific for each HVAC system, and shall give detailed step-by-step procedures for commissioning of the system.

a. The Commissioning procedures shall include detailed, product specific set-up procedures, configuration procedures, adjustment procedures, and calibration procedures for each device. Where the detailed product specific commissioning procedures are included in

manufacturer supplied manuals, reference may be made in the HVAC control system commissioning procedures to the manuals.

b. An HVAC control system commissioning procedures equipment list shall be included that lists the equipment to be used to accomplish commissioning. The list shall include manufacturer name, model number, equipment function, the date of the latest calibration, and the results of the latest calibration.

#### Performance Verification Test Procedures; G-AO

Six copies of the HVAC Control System Performance Verification Test Procedures, in booklet form and indexed, 60 days before the Contractor's scheduled test dates. The performance verification test procedures shall refer to the devices by their unique identifiers as shown, shall explain, step-by-step, the actions and expected results that will demonstrate that the HVAC control system performs in accordance with the sequences of operation, and other contract documents. An HVAC control system performance verification test equipment list shall be included that lists the equipment to be used during performance verification testing. The list shall include manufacturer name, model number, equipment function, the date of the latest calibration, and the results of the latest calibration.

#### Training; G-AO

An outline for the HVAC control system training course with a proposed time schedule. Approval of the planned training schedule shall be obtained from the Government at least 60 days prior to the start of the training. Six copies of HVAC control system training course material 30 days prior to the scheduled start of the training course. The training course material shall include the operation manual, maintenance and repair manual, and paper copies of overheads used in the course.

#### SD-06 Test Reports

##### Commissioning Report; G-AO

Six copies of the HVAC Control System Commissioning Report, in booklet form and indexed, within 30 days after completion of the system commissioning. The commissioning report shall include data collected during the HVAC control system commissioning procedures and shall follow the format of the commissioning procedures. The commissioning report shall include all configuration checksheets with final values listed for all parameters, setpoints, P, I, D setting constants, calibration data for all devices, results of adjustments, and results of testing.

##### Performance Verification Test; G-AO

Six copies of the HVAC Control System Performance Verification Test Report, in booklet form and indexed, within 30 days after completion of the test. The HVAC control system performance verification test report shall include data collected during the HVAC control system performance verification test. The original copies of all data gathered during the performance verification test shall be turned over to the Government after Government

approval of the test results.

#### SD-10 Operation and Maintenance Data

Operation Manual; G-AO  
Maintenance and Repair Manual; G-AO

Six copies of the HVAC Control System Operation Manual and HVAC Control System Maintenance and Repair Manual, for each HVAC control system, 30 days before the date scheduled for the training course.

#### 1.4 DELIVERY AND STORAGE

Products shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, and other contaminants, within the storage condition limits published by the equipment manufacturer. Dampers shall be stored so that seal integrity, blade alignment and frame alignment are maintained.

#### 1.5 OPERATION MANUAL

An HVAC control system operation manual in indexed booklet form shall be provided for each HVAC control system. The operation manual shall include the HVAC control system sequence of operation, and procedures for the HVAC system start-up, operation and shut-down. The operation manual shall include as-built HVAC control system detail drawings. The operation manual shall include the as-built configuration checksheets, the procedures for changing HVAC control system setpoints, and the procedures for placing HVAC system controllers in the manual control mode.

a. The procedures for changing HVAC control system setpoints shall describe the step-by-step procedures required to change the process variable setpoints, the alarm setpoints, the bias settings, and setpoint reset schedules.

b. The procedures for placing HVAC system controllers in the manual control mode shall describe step-by-step procedures required to obtain manual control of each controlled device and to manually adjust their positions.

#### 1.6 MAINTENANCE AND REPAIR MANUAL

An HVAC control system maintenance and repair manual in indexed booklet form in hardback binders shall be provided for each HVAC control system. The maintenance and repair manual shall include the routine maintenance checklist, a recommended repair methods list, a list of recommended maintenance and repair tools, the qualified service organization list, the as-built commissioning procedures and report, the as-built performance verification test procedures and report, and the as-built equipment data booklet.

a. The routine maintenance checklist shall be arranged in a columnar format. The first column shall list all devices listed in the equipment compliance booklet, the second column shall state the maintenance activity or state no maintenance required, the third column shall state the frequency of the maintenance activity, and the fourth column for additional comments or reference.

b. The recommended repair methods list shall be arranged in a columnar format and shall list all devices in the equipment data compliance booklet and state the guidance on recommended repair methods, either field repair, factory repair, or whole-item replacement.

c. The as-built equipment data booklet shall include the equipment compliance booklet and manufacturer supplied user manuals and information.

d. If the operation manual and the maintenance and repair manual are provided in a common volume, they shall be clearly differentiated and separately indexed.

#### 1.7 MAINTENANCE AND SERVICE

Services, materials and equipment shall be provided as necessary to maintain the entire system in an operational state as specified for a period of one year after successful completion and acceptance of the Performance Verification Test. Impacts on facility operations shall be minimized.

##### 1.7.1 Description of Work

The adjustment and repair of the system shall include the manufacturer's required adjustments of computer equipment, software updates, transmission equipment and instrumentation and control devices.

##### 1.7.2 Personnel

Service personnel shall be qualified to accomplish work promptly and satisfactorily. The Government shall be advised in writing of the name of the designated service representative, and of any changes in personnel.

##### 1.7.3 Scheduled Inspections

Two inspections shall be performed at six-month intervals and all work required shall be performed. Inspections shall be scheduled in June and December. These inspections shall include:

- a. Visual checks and operational tests of equipment.
- b. Fan checks and filter changes for control system equipment.
- c. Clean control system equipment including interior and exterior surfaces.
- d. Check and calibrate each field device. Check and calibrate 50 percent of the total analog points during the first inspection. Check and calibrate the remaining 50 percent of the analog points during the second major inspection. Certify analog test instrumentation accuracy to be twice that of the device being calibrated. Randomly check at least 25 percent of all digital points for proper operation during the first inspection. Randomly check at least 25 percent of the remaining digital points during the second inspection.
- e. Run system software diagnostics and correct diagnosed problems.
- f. Resolve any previous outstanding problems.

##### 1.7.4 Scheduled Work

This work shall be performed during regular working hours, Monday through Friday, excluding legal holidays.

#### 1.7.5 Emergency Service

The Government will initiate service calls when the system is not functioning properly. Qualified personnel shall be available to provide service to the system. A telephone number where the service supervisor can be reached at all times shall be provided. Service personnel shall be at the site within 24 hours after receiving a request for service. The control system shall be restored to proper operating condition within three calendar days after receiving a request for service.

#### 1.7.6 Operation

Scheduled adjustments and repairs shall include verification of the control system operation as demonstrated by the applicable tests of the performance verification test.

#### 1.7.7 Records and Logs

Dated records and logs shall be kept of each task, with cumulative records for each major component, and for the complete system chronologically. A continuous log shall be maintained for all devices. The log shall contain initial analog span and zero calibration values and digital points. Complete logs shall be kept and shall be available for inspection onsite, demonstrating that planned and systematic adjustments and repairs have been accomplished for the control system.

#### 1.7.8 Work Requests

Each service call request shall be recorded as received and shall include the serial number identifying the component involved, its location, date and time the call was received, nature of trouble, names of the service personnel assigned to the task, instructions describing what has to be done, the amount and nature of the materials to be used, the time and date work started, and the time and date of completion. A record of the work performed shall be submitted within 5 days after work is accomplished.

#### 1.7.9 System Modifications

Recommendations for system modification shall be submitted in writing. No system modifications, including operating parameters and control settings, shall be made without prior approval of the Government. Any modifications made to the system shall be incorporated into the operations and maintenance manuals, and other documentation affected.

#### 1.7.10 Software

Updates to the software shall be provided for system, operating and application software, and operation in the system shall be verified. Updates shall be incorporated into operations and maintenance manuals, and software documentation. There shall be at least one scheduled update near the end of the first year's warranty period, at which time the latest released version of the Contractor's software shall be installed and validated.

#### 1.8 NOT USED.

## PART 2 PRODUCTS

### 2.1 GENERAL EQUIPMENT REQUIREMENTS

Units of the same type of equipment shall be products of a single manufacturer. Each major component of equipment shall have the manufacturer's name and address, and the model and serial number in a conspicuous place. Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of such products, which are of a similar material, design and workmanship. The standard products shall have been in a satisfactory commercial or industrial use for two years prior to use on this project. The two years' use shall include applications of equipment and materials under similar circumstances and of similar size. The two years' experience shall be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation, for not less than 6,000 hours exclusive of the manufacturer's factory tests, can be shown. The equipment items shall be supported by a service organization. Items of the same type and purpose shall be identical, including equipment, assemblies, parts and components. Automatic temperature controls shall be direct digital controls that will provide the required sequence of operation.

#### 2.1.1 Electrical and Electronic Devices

Electrical, electronic, and electropneumatic devices not located within a DDC panel shall have a NEMA ICS 1 enclosure in accordance with NEMA 250 unless otherwise shown.

#### 2.1.2 Standard Signals

Except for air distribution terminal unit control equipment, the output of all analog transmitters and the analog input and output of all DDC controllers shall be 4-to-20 mA<sub>dc</sub> signals. The signal shall originate from current-sourcing devices and shall be received by current-sinking devices.

#### 2.1.3 Ambient Temperature Limits

DDC panels shall have ambient condition ratings of 35 to 120 degrees F and 10 to 95 percent relative humidity, noncondensing. Devices installed outdoors shall operate within limit ratings of minus 35 to plus 150 degrees F. Instrumentation and control elements shall be rated for continuous operation under the ambient environmental temperature, pressure, humidity, and vibration conditions specified or normally encountered for the installed location.

#### 2.1.4 Not Used.

### 2.2 NOT USED.

### 2.3 WIRING

#### 2.3.1 Terminal Blocks

Terminal blocks shall be insulated, modular, feed-through, clamp style with recessed captive screw-type clamping mechanism, shall be suitable for rail

mounting, and shall have end plates and partition plates for separation or shall have enclosed sides.

#### 2.3.2 Control Wiring for 24-Volt Circuits

Control wiring for 24-volt circuits shall be 18 AWG minimum, stranded copper and shall be rated for 300-volt service.

#### 2.3.3 Wiring for 120-Volt Circuits

Wiring for 120-volt circuits shall be 18 AWG minimum, stranded copper and shall be rated for 600-volt service.

#### 2.3.4 Instrumentation Cable

Instrumentation cable shall be 18 AWG, stranded copper, single- or multiple-twisted, minimum 2 inch lay of twist, 100 percent shielded pairs, and shall have a 300-volt insulation. Each pair shall have a 20 AWG tinned-copper drain wire and individual overall pair insulation. Cables shall have an overall aluminum-polyester or tinned-copper cable-shield tape, overall 20 AWG tinned-copper cable drain wire, and overall cable insulation.

#### 2.3.5 Transformers

Step down transformers shall be utilized where control equipment operates at lower than line circuit voltage. Transformers, other than transformers in bridge circuits, shall have primaries wound for the voltage available and secondaries wound for the correct control circuit voltage. Transformer shall be sized so that the connected load is 80 percent of the rated capacity or less. Transformers shall conform to UL 508 and NEMA ST 1.

### 2.4 ACTUATORS

Actuators shall be electric or electronic as shown and shall be provided with mounting and connecting hardware. Electric or electronic actuators shall be used for variable air volume (VAV) by-pass boxes. Actuators shall fail to their spring-return positions on signal or power failure. For by-pass boxes, the spring return position shall be the dampers minimum position. The actuator stroke shall be limited in the direction of power stroke by an adjustable stop. Actuators shall have a visible position indicator. Actuators shall smoothly open or close the devices to which they are applied and shall have a full stroke response time of 90 seconds or less. Electric actuators shall have an oil-immersed gear train.

Electric or electronic actuators operating in series shall have an auxiliary actuator driver. Electric or electronic actuators used in sequencing applications shall have an adjustable operating range and start point.

#### 2.4.1 Valve Actuators

Valve actuators shall be selected to provide a minimum of 125 percent of the motive power necessary to operate the valve over its full range of operation.

#### 2.4.2 Not Used.

### 2.5 AUTOMATIC CONTROL VALVES

Valves shall have stainless-steel stems and stuffing boxes with extended necks to clear the piping insulation. Unless otherwise stated, valves shall have globe style bodies. Valve bodies shall be designed for not less than 125 psig working pressure or 150 percent of the system operating pressure, whichever is greater. Valve leakage rating shall be 0.01 percent of rated Cv. Unless otherwise specified, bodies for valves 1-1/2 inches and smaller shall be brass or bronze, with threaded or union ends; bodies for 2 inch valves shall have threaded ends; and bodies for valves 2 to 3 inches shall be of brass, bronze or iron. Bodies for valves 2-1/2 inches and larger shall be provided with flanged-end connections. Valve Cv shall be determined by the controls contractor.

#### 2.5.1 Butterfly Valve Assembly

Butterfly valves shall be threaded lug type suitable for dead-end service and modulation to the fully-closed position, with carbon-steel bodies and noncorrosive discs, stainless steel shafts supported by bearings, and EPDM seats suitable for temperatures from minus 20 to plus 250 degrees F. Valves shall have a manual means of operation independent of the actuator. The rated Cv for butterfly valves shall be the value Cv at 70% open (60 degrees open).

#### 2.5.2 Two-Way Valves

Two-way modulating valves shall have equal-percentage characteristics.

#### 2.5.3 Three-Way Valves

Three-way valves shall provide linear flow control with constant total flow throughout full plug travel.

#### 2.5.4 Not Used.

#### 2.5.5 Valves for Heat Pump Cooling -Water

Internal valve trim shall be bronze except that valve stems may be type 316 stainless steel. Valve Cv shall be within 100 to 125 percent of the Cv as shown on the control drawings. Valves 4 inches and larger shall be butterfly.

#### 2.5.6 Valves for Hot-Water and Dual Temperature Service

For hot water service below 250 degrees F and dual-temperature service, internal trim (including seats, seat rings, modulating plugs, and springs) of valves controlling water hotter than 210 degrees F shall be Type 316 stainless steel. Internal trim for valves controlling water 210 degrees F or less shall be brass or bronze. Nonmetallic parts of hot-water control valves shall be suitable for a minimum continuous operating temperature of 250 degrees F or 50 degrees F above the system design temperature, whichever is higher. Valves 4 inches and larger shall be butterfly valves.

#### 2.5.7 Not Used.

#### 2.5.8 Not Used.

### 2.6 DAMPERS

#### 2.6.1 Damper Assembly

A single damper section shall have blades no longer than 48 inches and shall be no higher than 72 inches. Maximum damper blade width shall be 8 inches. Larger sizes shall be made from a combination of sections. Dampers shall be steel, or other materials where shown. Flat blades shall be made rigid by folding the edges. Blade-operating linkages shall be within the frame so that blade-connecting devices within the same damper section shall not be located directly in the air stream. Damper axles shall be 0.5 inch minimum, plated steel rods supported in the damper frame by stainless steel or bronze bearings. Blades mounted vertically shall be supported by thrust bearings. Pressure drop through dampers shall not exceed 0.04 inch water gauge at 1,000 feet per minute in the wide-open position. Frames shall not be less than 2 inches in width. Dampers shall be tested in accordance with AMCA 500.

#### 2.6.2 Operating Links

Operating links external to dampers, such as crankarms, connecting rods, and line shafting for transmitting motion from damper actuators to dampers, shall withstand a load equal to at least twice the maximum required damper-operating force. Rod lengths shall be adjustable. Links shall be brass, bronze, zinc-coated steel, or stainless steel. Working parts of joints and clevises shall be brass, bronze, or stainless steel. Adjustments of crankarms shall control the open and closed positions of dampers.

#### 2.6.3 Damper Types

Dampers shall be parallel-blade type.

##### 2.6.3.1 Outside Air, Return Air, and Relief Air Dampers

Outside air, return air and relief air dampers shall be provided where shown. Blades shall have interlocking edges and shall be provided with compressible seals at points of contact. The channel frames of the dampers shall be provided with jamb seals to minimize air leakage. Dampers shall not leak in excess of 20 cfm per square foot at 4 inches water gauge static pressure when closed. Seals shall be suitable for an operating temperature range of minus 40 to plus 200 degrees F. Dampers shall be rated at not less than 2,000 feet per minute air velocity.

##### 2.6.3.2 Mechanical and Electrical Space Ventilation Dampers

Mechanical and electrical space ventilation dampers shall be as shown. Dampers shall not leak in excess of 80 cfm square foot at 4 inches water gauge static pressure when closed. Dampers shall be rated at not less than 1,500 feet per minute air velocity.

##### 2.6.3.3 Not Used.

#### 2.6.4 Damper End Switches

Each end switch shall be a hermetically sealed switch with a trip lever and over-travel mechanism. The switch enclosure shall be suitable for mounting on the duct exterior and shall permit setting the position of the trip lever that actuates the switch. The trip lever shall be aligned with the damper blade.

#### 2.7 SMOKE DETECTORS

Duct smoke detectors shall be provided in supply and return air ducts in accordance with NFPA 90A. Duct smoke detectors shall conform to the requirements of UL 268A. Duct smoke detectors shall have perforated sampling tubes extended into the air duct. Detector circuitry shall be mounted in a metallic enclosure exterior to the duct. Detectors shall have manual reset. Detectors shall be rated for air velocities that include air flows between 500 and 4000 fpm. Detectors shall be powered from the fire alarm control panel (FACP). Detectors shall have two sets of normally open alarm contacts and two sets of normally closed alarm contacts. Detectors shall be connected to the building fire alarm panel for alarm initiation. A remote annunciation lamp and accessible remote reset switch shall be provided for duct detectors that are mounted eight feet or more above the finished floor and for detectors that are not readily visible. Remote lamps and switches as well as the affected fan units shall be properly identified in etched rigid plastic placards.

## 2.8 INSTRUMENTATION

### 2.8.1 Measurements

Where required, transmitters shall be calibrated to provide the following measurements, over the indicated ranges, for an output of 4 to 20 mAdc:

- a. Conditioned space temperature, from 50 to 85 degrees F.
- b. Duct temperature, from 40 to 140 degrees F.
- c. Not Used.
- d. Not Used.
- e. Dual-temperature water, from 30 to 240 degrees F.
- f. Heating hot-water temperature, from 50 to 250 degrees F.
- g. Condenser-water temperature, from 30 to 130 degrees F.
- h. Outside-air temperature, from minus 30 to 130 degrees F.
- i. Relative humidity, 0 to 100 percent for space and duct high-limit applications.
- j. Differential pressure.
- k. Pitot-tube air-flow measurement station and transmitter, from 0 to 0.1 inch water gauge for flow velocities of 700 to 1200 fpm, 0 to 0.25 inch water gauge for velocities of 700 to 1800 fpm, or 0 to 0.5 inch water gauge for velocities of 700 to 2500 fpm.
- l. Electronic air-flow measurement station and transmitter, from 125 to 2500 fpm.

### 2.8.2 Temperature Instruments

#### 2.8.2.1 Resistance Temperature Detectors (RTD)

Temperature sensors shall be 100 ohms 3- or 4-wire RTD. Each RTD shall be platinum with a tolerance of 0.54 degrees F at 32 degrees F with a temperature coefficient of resistance (TCR) of .00214 ohms/ohm/deg F and

shall be encapsulated in epoxy, series 300 stainless steel, anodized aluminum, or copper. Each RTD shall be furnished with an RTD transmitter as specified, integrally mounted unless otherwise shown.

#### 2.8.2.2 Continuous Averaging RTD

Continuous averaging RTDs shall have a tolerance of plus or minus 1.0 degree F at the reference temperature, and shall be of sufficient length to ensure that the resistance represents an average over the cross section in which it is installed. The sensing element shall have a bendable copper sheath. Each averaging RTD shall be furnished with an RTD transmitter to match the resistance range of the averaging RTD.

#### 2.8.2.3 RTD Transmitter

The RTD transmitter shall match the resistance range of the RTD. The transmitter shall be a two-wire, loop powered device. The transmitter shall produce a linear 4-to-20 mAdc output corresponding to the required temperature measurement. The output error shall not exceed 0.1 percent of the calibrated measurement.

#### 2.8.3 Relative Humidity Instruments

A relative-humidity instrument for indoor application shall have a measurement range from 0 to 100 percent relative-humidity and be rated for operation at ambient air temperatures within the range of 25 to 130 degrees F. It shall be capable of being exposed to a condensing air stream (100 percent RH) with no adverse effect to the sensor's calibration or other harm to the instrument. The instrument shall be of the wall-mounted or duct-mounted type, as required by the application, and shall be provided with any required accessories. Instruments used in duct high-limit applications shall have a bulk polymer resistive sensing element. Duct-mounted instruments shall be provided with a duct probe designed to protect the sensing element from dust accumulation and mechanical damage. The instrument (sensing element and transmitter) shall be a two-wire, loop-powered device and shall have an accuracy of plus or minus three percent of full scale within the range of 20 to 80 percent relative humidity. The instrument shall have a typical long-term stability of 1 percent or less drift per year. The transmitter shall convert the sensing element's output to a linear 4-20 mAdc output signal in proportion to the measured relative-humidity value. The transmitter shall include offset and span adjustments.

#### 2.8.4 Not Used.

#### 2.8.5 Not Used.

#### 2.8.6 Differential Pressure Instruments

The instrument shall be a pressure transmitter with an integral sensing element. The instrument over pressure rating shall be 300 percent of the operating pressure. The sensor/transmitter assembly accuracy shall be plus or minus two percent of full scale. The transmitter shall be a two-wire, loop-powered device. The transmitter shall produce a linear 4-to-20 mAdc output corresponding to the required pressure measurement.

#### 2.8.7 Thermowells

Thermowells shall be Series 300 stainless steel with threaded brass plug

and chain, 2 inch lagging neck and extension type well. Inside diameter and insertion length shall be as required for the application.

#### 2.8.8 Sunshields

Sunshields for outside air temperature sensing elements shall prevent the sun from directly striking the temperature sensing elements. The sunshields shall be provided with adequate ventilation so that the sensing element responds to the ambient temperature of the surroundings. The top of each sunshield shall have a galvanized metal rainshield projecting over the face of the sunshield. The sunshields shall be painted white.

#### 2.9 THERMOSTATS

Thermostat ranges shall be selected so that the setpoint is adjustable without tools between plus or minus 10 degrees F of the setpoint shown. Thermostats shall be electronic or electric.

##### 2.9.1 Nonmodulating Room Thermostats (For Supply Fan, Exhaust Fan and Unit Heater Control).

Contacts shall be single-pole double-throw (SPDT), hermetically sealed, and wired to identified terminals. Maximum differential shall be 5 degrees F.

##### 2.9.2 Not Used.

##### 2.9.3 Modulating Room Thermostats

Modulating room thermostats shall have either one output signal, two output signals operating in unison, or two output signals operating in sequence, as required for the application. Each thermostat shall have an adjustable throttling range of 4 to 8 degrees F for each output. Room thermostats shall be enclosed with separate locking covers (guards).

##### 2.9.4 Nonmodulating Capillary Thermostats and Aquastats

Each thermostat shall have a capillary length of at least 5 feet, shall have adjustable direct-reading scales for both setpoint and differential, and shall have a differential adjustable from 6 to 16 degrees F. Aquastats shall be of the strap on type, with 10 degrees F fixed differential.

##### 2.9.5 Freezestats

Freezestats shall be manual reset, low temperature safety thermostats, with NO and NC contacts and a 20 foot element which shall respond to the coldest 18 inch segment.

##### 2.9.6 Modulating Capillary Thermostats

Each thermostat shall have either one output signal, two output signals operating in unison, or two output signals operating in sequence, as required for the application. Thermostats shall have adjustable throttling ranges of 4 to 8 degrees F for each output.

##### 2.9.7 Not Used.

#### 2.10 PRESSURE SWITCHES AND SOLENOID VALVES

### 2.10.1 Pressure Switches

Each switch shall have an adjustable setpoint with visible setpoint scale. Range shall be as shown. Differential adjustment shall span 20 to 40 percent of the range of the device.

### 2.10.2 Differential-Pressure Switches

Each switch shall be an adjustable diaphragm-operated device with two SPDT contacts, with taps for sensing lines to be connected to duct pressure fittings designed to sense air pressure. These fittings shall be of the angled-tip type with tips pointing into the air stream. The setpoint shall not be in the upper or lower quarters of the range and the range shall not be more than three times the setpoint. Differential shall be a maximum of 0.15 inch water gauge at the low end of the range and 0.35 inch water gauge at the high end of the range.

### 2.10.3 Not Used.

### 2.10.4 Not Used.

## 2.11 INDICATING DEVICES

### 2.11.1 Thermometers

Mercury shall not be used in thermometers.

#### 2.11.1.1 Piping System Thermometers

Piping system thermometers shall have brass, malleable iron or aluminum alloy case and frame, clear protective face, permanently stabilized glass tube with indicating-fluid column, white face, black numbers, and a 9 inch scale. Thermometers for piping systems shall have rigid stems with straight, angular, or inclined pattern.

#### 2.11.1.2 Piping System Thermometer Stems

Thermometer stems shall have expansion heads as required to prevent breakage at extreme temperatures. On rigid-stem thermometers, the space between bulb and stem shall be filled with a heat-transfer medium.

#### 2.11.1.3 Nonaveraging Air-Duct Thermometers

Air-duct thermometers shall have perforated stem guards and 45-degree adjustable duct flanges with locking mechanism.

#### 2.11.1.4 Averaging Air-Duct Thermometers

Averaging thermometers shall have a 3-1/2 inch (nominal) dial, with black legend on white background, and pointer traveling through a 270-degree arc.

#### 2.11.1.5 Accuracy

Thermometers shall have an accuracy of plus or minus one percent of scale range. Thermometers shall have a range suitable for the application.

### 2.11.2 Pressure Gauges

Gauges shall be 2 inch (nominal) size, back connected, suitable for field

or panel mounting as required, shall have black legend on white background, and shall have a pointer traveling through a 270-degree arc. Accuracy shall be plus or minus three percent of scale range. Gauges shall meet requirements of ASME B40.1.

2.11.2.1 Not Used.

2.11.2.2 Not Used.

2.11.2.3 Hydronic System Gauges

Gauges for hydronic system applications shall have ranges and graduations as shown.

2.11.3 Low Differential Pressure Gauges

Gauges for low differential pressure measurements shall be a minimum of 3.5 inch (nominal) size with two sets of pressure taps, and shall have a diaphragm-actuated pointer, white dial with black figures, and pointer zero adjustment. Gauges shall have ranges and graduations as shown. Accuracy shall be plus or minus two percent of scale range.

2.12 CONTROL DEVICES AND ACCESSORIES

2.12.1 Relays

Control relay contacts shall have utilization category and ratings selected for the application, with a minimum of two sets of contacts (two normally open, two normally closed) enclosed in a dustproof enclosure. Relays shall be rated for a minimum life of one million operations. Operating time shall be 20 milliseconds or less. Relays shall be equipped with coil transient suppression devices to limit transients to 150 percent of rated coil voltage. Time delay relays shall be 2PDT with eight-pin connectors, dust cover, and a matching rail-mounted socket. Adjustable timing range shall be 0 to 5 minutes. Power consumption shall not be greater than three watts.

2.12.2 Not Used.

2.12.3 Joule or Watthour Meters

Watthour meters shall be in accordance with ANSI C12.1 and have pulse initiators for remote monitoring of Watthour consumption. Pulse initiator shall consist of form C contacts with a current rating not to exceed two amperes and voltage not to exceed 500 V, with combinations of VA not to exceed 100 VA, and a life rating of one billion operations. Meter sockets shall be in accordance with ANSI C12.1.

2.12.4 Joule or Watthour Meters with Demand Register

Meters shall be in accordance with ANSI C12.1 and shall have pulse initiators for remote monitoring of Watthour consumption and instantaneous demand. Pulse initiators shall consist of form C contacts with a current rating not to exceed two amperes and voltage not to exceed 500 V, with combinations of VA not to exceed 100 VA, and a life rating of one billion operations. Meter sockets shall be in accordance with ANSI C12.1

2.12.5 Joule or Watthour Transducers

Watt-hour transducers shall have an accuracy of plus or minus 0.25 percent for kW and kWh outputs from full lag to full lead power factor. Input ranges for kW and kWh transducers shall be selectable without requiring the changing of current or potential transformers. The output shall be 4 to 20 mA dc.

#### 2.12.6 Current Sensing Relays

Current sensing relays shall provide a normally-open contact rated at a minimum of 50 volts peak and 1/2 ampere or 25 VA, noninductive. There shall be a single hole for passage of current carrying conductors. The devices shall be sized for operation at 50 percent rated current based on the connected load. Voltage isolation shall be a minimum of 600 volts.

#### 2.12.7 Power-Line Conditioners (PLC)

Power line conditioners shall be furnished for each DDC panel. The PLCs shall provide both voltage regulation and noise rejection. The PLCs shall be of the ferro-resonant design, with no moving parts and no tap switching, while electrically isolating the secondary from the power-line side. The PLCs shall be sized for 125 percent of the actual connected kVA load. Characteristics of the PLC shall be as follows:

a. At 85 percent load, the output voltage shall not deviate by more than plus or minus one percent of nominal when the input voltage fluctuates between minus 20 percent to plus 10 percent of nominal.

b. During load changes of zero to full load, the output voltage shall not deviate by more than plus or minus three percent of nominal voltage. Full correction of load switching disturbances shall be accomplished within five cycles, and 95 percent correction shall be accomplished within two cycles of the onset of the disturbance.

c. Total harmonic distortion shall not exceed 3-1/2 percent at full load.

#### 2.13 NOT USED.

#### 2.14 DIRECT DIGITAL CONTROL (DDC) HARDWARE

All functions, constraints, data base parameters, operator developed programs and any other data shall be downloadable from a portable workstation/tester to network control panels, RIU's, universal programmable controllers, and unitary controllers. Download shall be accomplished through both the primary network and the local DDC portable workstation/tester port.

##### 2.14.1 Network Control Panel

Network control panels shall be microcomputer-based with sufficient memory provided to perform all specified and shown network control panel functions and operations, including spare capacity for all spares and its I/O functions specified. Each network control panel and remote I/O units (RIU) shall have a minimum of 10% of its I/O functions as spare capacity but not less than 2 of each type used in each. The type of spares shall be in the same proportion as the implemented I/O functions on the panel, but in no case shall there be less than two spare points of each type. The panel I/O functions shall be furnished complete, with no changes or additions necessary to support implementation of spare functions. Output relays

associated with digital signals shall be considered part of the I/O function, whether physically mounted in the enclosure or separately mounted. Implementation of spare points shall necessitate only providing the additional field sensor or control device, field wiring including connection to the system, and point definition assignment by the operator using the portable workstation/tester. The panel shall contain all necessary I/O functions to connect to field sensors and control panels. I/O function operation shall be fully supervised to detect I/O function failures. Network control panels shall operate in an independent stand-alone mode, which is defined as all network control panel operations performed by the network control panel without any continuing input from other Direct digital controls or portable workstation/tester. The network control panel shall be capable of controlling a mix of at least 32 RIUs, unitary controllers, and universal programmable controllers.

#### 2.14.1.1 Integral Features

The network control panel shall include:

- a. Main power switch.
- b. Power on indicator.
- c. Portable workstation/tester port, connector, and if necessary power supply.
- d. Manufacturers control network port.
- e. On-Off-Auto switches for each DO which controls a device. These switches shall be mounted in the field panel, with the exception of motors, for which the switch shall be mounted at the motor control center. On-Off-Auto switches are not required for DO associated with a status or alarm such as pilot lights. The status of these switches shall be available to the panel for further processing.
- f. Minimum-Maximum-Auto switches, or Auto-Manual switches with manual output override, for each AO. The status of these shall be available to the panel for further processing.
- g. An intrusion detection device, connected as an alarm.

#### 2.14.1.2 Communication Interfaces

The following communication capabilities shall function simultaneously.

- a. Manufacturers Control Network. Manufacturers control network communications interfaces for each data transmission systems (DTS) circuit between network control panels and RIUs, unitary controllers, and universal programmable controllers, shall be provided. Communication interfaces shall be provided between each network control panel and associated I/O functions. The DTS will provide for transmission speeds necessary to comply with performance requirements specified. DTS equipment shall be installed in the network control panel enclosure.
- b. Portable Workstation/Tester Port. A communications port for interfacing to a portable workstation/tester shall be provided. Network control panel workstation/tester port other than RS-232, shall be converted to RS-232, including cabling and power supply, and shall be permanently installed in the panel.

c. Primary Network Port. The network control panel shall either have a built in primary network Port or be capable of accepting a primary network port expansion card for future networking to a base wide utility monitoring and control system (UMCS). The primary network port expansion card shall be either Ethernet (IEEE802.3) or ARCNET.

#### 2.14.1.3 Memory and Real Time Clock (RTC) Backup

The network control panel memory and real time clock functions shall continue to operate for a minimum of 72 hours in the event of a power failure. If rechargeable batteries are provided, automatic charging of batteries shall be provided. Whenever a either a permanent workstation/tester or portable workstation/tester is monitoring the network control panel, a low battery alarm message shall be sent to it.

#### 2.14.1.4 Duplex Outlet

A single phase, 120 Vac electrical service outlet for use with test equipment shall be furnished either inside or within 6 feet of the network control panel enclosure.

#### 2.14.1.5 Locking Enclosures

Locking type mounting cabinets with common keying shall be furnished for each network control panel.

#### 2.14.1.6 Failure Mode

Upon failure of the network control panel, either due to failure of the network control panel hardware or of the manufacturers control network, the network control panel shall revert to the failure mode as shown.

a. Manufacturers Control Network Failure: Upon failure of the manufacturers control network, the network control panel shall operate in an independent stand-alone mode.

b. Network Control Panel Hardware Failure: Upon failure of the network control panel hardware, the network control panel shall cease operation and stop communications with other network control panels, RIUs, unitary controllers and universal programmable controllers connected to the affected network control panel. The affected network control panel shall respond to this failure as specified and shown.

#### 2.14.2 RIU

The RIU shall be functionally a part of the network control panel as specified, but may be remotely located from the network control panel and communicate over a dedicated communication circuit. When remotely located, the I/O functions shall be subject to the same requirements as for the network control panel hardware. RIUs shall be used to connect remote inputs and outputs to a network control panel and shall contain all necessary I/O functions to connect to field sensors and control devices. RIU operation shall be fully supervised by the network control panel to detect failures. Each RIU shall have a minimum of 10 % of its I/O functions as spare capacity. The type of spares shall be in the same proportion as the implemented I/O functions on the RIU, but in no case shall there be less than two spare points of each type. The RIU shall be furnished complete, with no changes or additions necessary to support

implementation of spare functions. Output relays associated with digital signals shall be considered part of the I/O function, whether physically mounted in the enclosure or separately mounted. Implementation of spare points by others shall require only providing the additional field sensor or control device, field wiring including connection to the system, and point definition assignment by the operator. The RIU shall either report the status of all connected points on each scan, or report the status of all points which have changed state or value since the previous scan.

#### 2.14.2.1 Integral Features

The RIU shall include:

- a. Main power switch.
- b. Power on indicator.
- c. Portable workstation/tester port, connector, and if necessary power supply.
- d. Manufacturers control network port.
- e. On-Off-Auto switches for each DO which controls a device. These switches shall be mounted in the RIU, with the exception of motors, for which the switch shall be mounted at the motor control center. On-Off-Auto switches are not required for DO associated with a status or alarm such as pilot lights. The status of these switches shall be available to the RIU for further processing.
- f. Minimum-Maximum-Auto switches, or Auto-Manual switches with manual output override, for each AO. The status of these shall be available to the panel for further processing.
- g. An intrusion detection device, connected as an alarm.

#### 2.14.2.2 Duplex Outlet

A single phase, 120 Vac electrical service outlet for use with test equipment shall be furnished either inside or within 6 feet of the RIU.

#### 2.14.2.3 Locking Enclosures

Locking type mounting cabinets with common keying shall be furnished for each RIU.

#### 2.14.2.4 Failure Mode

Upon failure of the RIU, either due to failure of the RIU hardware or of the DTS, the RIU shall revert to the failure mode shown.

#### 2.14.3 Universal Programmable Controller (UPC)

The universal programmable controller shall be a microprocessor based controller designed and programmed to control and monitor systems as shown.

Resident programs shall be contained in reprogrammable nonvolatile memory. Each universal programmable controller shall contain necessary power supplies, transformers, memory, I/O functions and communications interfaces necessary to perform its required functions and to provide control and monitoring of connected equipment and devices. It shall contain all

necessary I/O functions to connect to field sensors and controls. I/O operation shall be fully supervised to detect I/O function failures. It shall provide for operation as a device connected to the system via the manufacturers control network.

#### 2.14.3.1 Integral Features

The universal programmable controller shall include as a minimum:

- a. Main power switch.
- b. Power on indicator.
- c. Portable workstation/tester port, connector, and if necessary power supply.
- d. Manufacturers control network port.
- e. I/O functions
  - (1) 8 DI
  - (2) 4 DO
  - (3) 8 AI
  - (4) 4 AO
  - (5) 1 PA
- f. On-Off-Auto switches for each DO which controls a device. These switches shall be mounted in the universal programmable controller, with the exception of motors, for which the switch shall be mounted at the motor control center. On-Off-Auto switches are not required for DO associated with a status or alarm such as pilot lights. The status of these switches shall be available to the panel for further processing.
- g. Minimum-Maximum-Auto switches, or Auto-Manual switches with manual output override, for each AO. The status of these shall be available to the panel for further processing.

#### 2.14.3.2 Communication Interfaces

The UPC shall have the following communication capabilities which shall function simultaneously.

- a. Manufacturers Control Network. The manufacturers control network communications interface for a data transmission systems (DTS) circuit between the UPC and a network control panels shall be provided. The DTS will provide for transmission speeds necessary to comply with performance requirements specified. DTS equipment shall be installed in the UPC Panel enclosure.
- b. Portable Workstation/Tester Port. A communications port for interfacing to a portable workstation/tester shall be provided. A UPC workstation/tester port other than RS-232, shall be converted to RS-232, including cabling and power supply, and shall be permanently installed in the panel.

#### 2.14.3.3 Memory and RTC Backup

The UPC memory and real time clock functions shall continue to operate for a minimum of 72 hours in the event of a power failure. If rechargeable batteries are provided, automatic charging of batteries shall be provided. Whenever either a permanent workstation/tester or portable workstation/tester is monitoring the network control panel, a low battery alarm message shall be sent to it.

#### 2.14.3.4 Specific Requirements

Each universal programmable controller shall be accessible for purposes of application selection, control parameters, set point adjustment, and monitoring from any DDC controller connected to the same manufacturers control network as the universal programmable controller. This shall be done using a portable workstation/tester connected to a portable workstation/tester port either directly or via modem.

#### 2.14.3.5 Locking Enclosures

Locking type mounting cabinets with common keying shall be furnished for each enclosure.

#### 2.14.3.6 Failure Mode

Upon failure of the universal programmable controller, it shall revert to the failure mode of operation as shown.

#### 2.14.4 Unitary Controller

The unitary controller shall be a microprocessor based, stand-alone, dedicated purpose controller, communicating with the network control panel, designed and programmed to control air distribution system mixing boxes, terminal units, heat pumps, fan coil units, self-contained DX units or VAV boxes as shown. Each unitary controller shall contain resident programs in nonvolatile memory for each specific application implemented. Each unitary controller shall contain necessary power supplies, transformers, memory, I/O functions and communications interfaces necessary to perform its required functions and to provide control and monitoring of connected equipment and devices. It shall contain all necessary I/O functions to connect to field sensors and controls. I/O operation shall be fully supervised to detect I/O function failures and shall provide for operation as a device connected to the network control panel via the manufacturers control network.

##### 2.14.4.1 Integral Features

The unitary controller shall include:

- a. Main power switch.
- b. Power on indicator.
- c. Portable workstation/tester port, connector, and power supply.
- d. Manufacturers control network port.
- e. All I/O functions required to implement the requirements as shown.

f. On-Off-Auto switches for each DO which controls a device. These switches shall be mounted in the field panel, with the exception of motors, for which the switch shall be mounted at the motor control center. On-Off-Auto switches are not required for DO associated with a status or alarm such as pilot lights. The status of these switches shall be available to the panel for further processing.

g. Minimum-Maximum-Auto switches, or Auto-Manual switches with manual output override, for each AO. The status of these shall be available to the panel for further processing.

#### 2.14.4.2 Communication Interfaces

The unitary controller shall have the following communication capabilities which shall function simultaneously.

a. Manufacturers Control Network. The manufacturers control network communications interface for a data transmission systems (DTS) circuit between the unitary controller and a network control panel shall be provided. The DTS will provide for transmission speeds necessary to comply with performance requirements specified. DTS equipment shall be installed in the unitary control panel enclosure.

b. Portable Workstation/Tester Port. A communications port for interfacing to a portable workstation/tester shall be provided. A unitary controller workstation/tester port other than RS-232, shall be converted to RS-232, including cabling and power supply, and shall be permanently installed in the panel. For unitary controller applications where the controller is not mounted in an enclosure, such as for fan-coil units or VAV terminal units, a portable conversion device for an RS-232 connection to the portable workstation/tester may be provided.

#### 2.14.4.3 Specific Requirements

Unitary controller components for new air distribution terminal units shall be furnished to the air distribution terminal unit manufacturer for factory mounting and calibration. Existing air distribution terminal units shall be controlled by field installed unitary controllers.

a. Accessibility and Interfaces: Each unitary controller shall be accessible for purposes of application selection, control parameters, set point adjustment, and monitoring using a portable workstation/tester connected to the manufacturers control network. They shall also be accessible with a portable workstation/tester connected to the unitary controller portable workstation/tester port.

b. Air Distribution Terminal Unit Controls: Controls shall consist of a room temperature sensor, a damper actuator, and an adjustable microprocessor-based controller. The room temperature sensor shall have occupant setpoint adjustment and temperature display, timed override of unoccupied mode, and a communication port. The controller shall operate the damper for cooling and heating. This controller capability shall allow the sequencing of the damper to maintain conditions in the space.

c. Not Used.

d. Air Distribution Terminal Unit Damper Actuator: Air distribution terminal unit damper actuator shall open or close the device to which it is connected within 60 seconds. The damper actuator shall utilize spring

return to fail to minimum position shown on loss of power or control signal.

#### 2.14.4.4 Failure Mode

Upon failure of the unitary controller, it shall revert to the failure mode of operation as shown.

#### 2.14.5 Heat Pump Unit Control Panel

Heat pump unit control panel shall be microprocessor-based and shall provide, both locally and through the Manufacturers Control Network, the control, monitoring, and safety equipment functions provided by the heat pump manufacturer's control panel. The control panel instrumentation and control ranges and accuracies shall match those of the heat pump manufacturer's control devices. The chiller panel shall have a communication port for interface to a Portable Workstation/Tester through either the Manufacturers Control Network or modem for start/stop, chilled water temperature reset, and monitoring of chiller operating status, alarms, and power consumption.

#### 2.14.6 Boiler Control Panel

Boiler control panel shall be microprocessor-based and shall provide, both locally and through the Manufacturers Control Network, the control, monitoring, and safety equipment functions provided by the boiler manufacturer's control panel(s) (two communications ports total). The boiler control panel instrumentation and controls ranges and accuracies shall match those of the boiler manufacturer's control devices. The boiler panel shall have a communication port for interface to a Portable Workstation/Tester through either the Manufacturers Control Network or modem for boiler(s) and start/stop, boiler water temperature reset, and monitoring of boiler operating status, alarms.

#### 2.14.7 I/O Functions

##### 2.14.7.1 DDC Hardware I/O Functions

I/O Functions shall be provided as part of the DDC system and shall be in accordance with the following:

a. The analog input (AI) function shall monitor each analog input, perform A-to-D conversion, and hold the digital value in a buffer for interrogation. The A-to-D conversion shall have a minimum resolution of 10 bits plus sign. Signal conditioning shall be provided for each analog input. Analog inputs shall be individually calibrated for zero and span, in hardware or in software. The AI shall incorporate common mode noise rejection of 50 dB from 0 to 100 Hz for differential inputs, and normal mode noise rejection of 20 dB at 60 Hz from a source impedance of 10,000 ohms. Input ranges shall be within the range of 4-to-20 mAdc.

b. The analog output (AO) function shall accept digital data, perform D-to-A conversion, and output a signal within the range of 4-to-20 mAdc. D-to-A conversion shall have a minimum resolution of eight bits plus sign. Analog outputs shall be individually calibrated for zero and span. Short circuit protection on voltage outputs and open circuit protection on current outputs shall be provided.

c. The digital input (DI) function shall accept on-off, open-close, or other change of state (two state data) indications. Isolation and

protection against an applied steady-state voltage up to 180 Vac peak shall be provided.

d. The digital output (DO) function shall provide contact closures for momentary and maintained operation of output devices. Closures shall have a minimum duration of 0.1 second. DO relays shall have an initial breakdown voltage between contacts and coil of at least 500 V peak. Electromagnetic interference suppression shall be furnished on all output lines to limit transients to nondamaging levels. Protection against an applied steady-state voltage up to 180 Vac peak shall be provided. Minimum contact rating shall be one ampere at 24 Vac.

e. The pulse accumulator function shall have the same characteristics as the DI. In addition, a buffer shall be provided to totalize pulses and allow for interrogation by the DDC system. The pulse accumulator shall accept rates up to 20 pulses per second. The totalized value shall be reset to zero upon operator's command.

f. Signal conditioning for sensors shall be provided as specified.

g. The binary coded decimal (BCD) function: The BCD function shall have the same characteristics as the DI, except that, in addition, a buffer shall be provided to totalize inputs and allow for interrogation by the network control panel. The BCD function shall have 16-channel optically isolated buffered inputs to read four digit numbers. The BCD function shall accumulate inputs at rates up to 10 inputs per second.

#### 2.14.7.2 Failure Mode

Upon failure of the I/O function, including data transmission failure, logic power supply failure, DDC processor malfunction, software failure, interposing relay power failure, or any other failure which prevents stand alone operation of any DDC normally capable of stand alone operation, connected outputs shall be forced to the failure mode shown.

#### 2.14.8 Portable Workstation/Tester

A portable workstation/tester shall be provided and shall be able to connect to any DDC hardware. The portable workstation/tester shall consist of a portable computer with a nominal 10 inch active color matrix liquid crystal display, capable of displaying up to 256 colors at a minimum resolution of 640 X 480 pixels, an external VGA monitor port, 32 bit microprocessor operating at a minimum of 100 MHZ. The portable workstation/tester shall have, as a minimum, a 1200 MB hard drive, 16 megabytes of memory, integral pointing device, serial and parallel ports, color VGA video port for an external color monitor, 3.5 inch floppy disk drive, modem, PCMCIA type 3 slot, rechargeable battery, battery charger and 120 Vac power supply. It shall include carrying case, extra battery, charger and a compatible network adapter. The workstation/tester shall:

- a. Run DDC diagnostics.
- b. Load all DDC memory resident programs and information, including parameters and constraints.
- c. Display any AI, DI, AO, DO, or PA point in engineering units for analog points or status for digital points.
- d. Control any AO or DO.

e. Provide an operator interface, contingent on password level, allowing the operator to use full English language words and acronyms, or an object oriented graphical user interface.

f. Display database parameters.

g. Modify database parameters.

h. Accept DDC software and information for subsequent loading into a specific DDC. Provide all necessary software and hardware required to support this function, including an EIA ANSI/EIA/TIA-232-F port.

i. Disable/enable each DDC.

j. Perform all workstation functions as specified.

#### 2.14.9 Not Used

a. Run DDC diagnostics.

b. Load all DDC memory resident programs and information, including parameters and constraints.

c. Display any AI, DI, AO, DO, or PA point in engineering units for analog points or status for digital points.

d. Control any AO or DO.

e. Provide an operator interface, contingent on password level, allowing the operator to use full English language words and acronyms, or an object oriented graphical user interface.

f. Display database parameters.

g. Modify database parameters.

h. Accept DDC software and information for subsequent loading into a specific DDC. Provide all necessary software and hardware required to support this function, including an EIA ANSI/EIA/TIA-232-F port.

i. Disable/enable each DDC.

j. Perform all workstation functions as specified.

#### 2.14.10 Not Used

### 2.15 DDC SOFTWARE

All DDC software described in this specification shall be furnished as part of the complete DDC System.

#### 2.15.1 Operating System

Each DDC shall contain an operating system that controls and schedules that DDC's activities in real time. The DDC shall maintain a point database in its memory that includes all parameters, constraints, and the latest value or status of all points connected to that DDC. The execution of DDC application programs shall utilize the data in memory resident files. The

operating system shall include a real time clock function that maintains the seconds, minutes, hours, date and month, including day of the week. Each DDC real time clock shall be automatically synchronized with the network control panel real time clock at least once per day to plus or minus 10 seconds. The time synchronization shall be accomplished without operator intervention and without requiring system shutdown.

#### 2.15.1.1 Startup

The DDC shall have startup software that causes automatic commencement of operation without human intervention, including startup of all connected I/O functions. A DDC restart program based on detection of power failure at the DDC shall be included in the DDC software. Upon restoration of power to the DDC, the program shall restart equipment and restore loads to the state at time of power failure, or to the state as commanded by time programs or other overriding programs. The restart program shall include start time delays between successive commands to prevent demand surges or overload trips. The startup software shall initiate operation of self-test diagnostic routines. Upon failure of the DDC, if the database and application software are no longer resident or if the clock cannot be read, the DDC shall not restart and systems shall remain in the failure mode indicated until the necessary repairs are made. If the database and application programs are resident, the DDC shall resume operation after an adjustable time delay of from 0 to 600 seconds. The startup sequence for each DDC shall include a unique time delay setting for each control output when system operation is initiated.

#### 2.15.1.2 Operating Mode

Each DDC shall control and monitor functions as specified, independent of communications with other DDC. This software shall perform all DDC functions and DDC resident application programs as specified using data obtained from I/O functions and based upon the DDC real time clock function. When communications circuits between the DDC are operable, the DDC shall obtain real time clock updates and any required global data values transmitted from other network control panels. The DDC software shall execute commands after performing constraints checks in the DDC. Status and analog values, including alarms and other data shall be transmitted from other network control panels when communications circuits are operable. If communications are not available, each DDC shall function in stand-alone mode and operational data, including the latest status and value of each point and results of calculations, normally transmitted from other network control panels shall be stored for later transmission to the network control panel. Storage for the latest 256 values shall be provided at each network control panel. Each DDC shall accept software downloaded from the network control panel. Constraints shall reside at the DDC.

#### 2.15.1.3 Failure Mode

Upon failure for any reason, each DDC shall perform an orderly shutdown and force all DDC outputs to a predetermined (failure mode) state, consistent with the failure modes shown and the associated control device.

#### 2.15.2 Functions

The Contractor shall provide software necessary to accomplish the following functions, as appropriate, fully implemented and operational, within each network control panel, RIU, unitary controller and universal programmable controller.

- a. Scanning of inputs.
- b. Control of outputs.
- c. Reporting of analog changes outside a selectable differential.
- d. Reporting of unauthorized digital status.
- e. Reporting of alarms automatically to network control panel.
- f. Reporting of I/O status to network control panel upon request.
- g. Maintenance of real time, updated by the network control panel at least once a day.
- h. Communication with the network control panel.
- i. Execution of DDC resident application programs.
- j. Averaging or filtering of AIs.
- k. Constraints checks (prior to command issuance).
- l. Diagnostics.
- m. Portable workstation/tester operation as specified.
- n. Reset of PA by operator based on time and value.

#### 2.15.2.1 Analog Monitoring

The system shall measure and transmit analog values including calculated analog points. An analog change in value is defined as a change exceeding a preset differential value as specified. The record transmitted for each analog value shall include a readily identifiable flag which indicates the abnormal status of the value when it deviates from operator selectable upper and lower analog limits. Analog values shall be expressed in proper engineering units with sign. Engineering units conversions shall be provided for each measurement. Each engineering units conversion set shall include range, span, and conversion equation. A vocabulary of engineering unit descriptors shall be provided, using at least three alphanumeric characters to identify information in the system. The system shall support 255 different engineering units.

#### 2.15.2.2 Logic (Virtual) Points

Logic (virtual) points shall be software points entered in the point database which are not directly associated with a physical I/O function. Logic (virtual) points shall be analog or digital points created by calculation from any combination of digital and analog points, or other data having the properties of real points, including alarms, without the associated hardware. Logic (virtual) points shall be defined or calculated and entered into the database by the Contractor. The calculated analog point shall have point identification in the same format as any other analog point. The calculated point shall be used in any program where the real value is not obtainable directly. Constants used in calculations shall be changeable on-line by the operator. Calculated point values shall be current for use by the system within 10 seconds of the time of any input

changes.

#### 2.15.2.3 State Variables

If an analog point represents more than two (up to eight) specific states, each state shall be nameable. For example, a level sensor shall be displayed at its measured engineering units plus a state variable with named states usable in programs or for display such as low alarm/low/normal/high/high alarm.

#### 2.15.2.4 Analog Totalization

Any analog point shall be operator assignable to the totalization program. Up to eight analog values shall be totalized within a selectable time period. At the end of the period, the totals shall be stored. Totalization shall then restart from zero for the next time period. The program shall keep track of the peak and total value measured during the current period and for the previous period. The operator shall be able to set or reset each totalized value individually. The time period shall be able to be operator defined, modified or deleted on-line.

#### 2.15.2.5 Energy Totalization

The system shall calculate the heat energy in Btus, for each energy source consumed by the mechanical systems specified, totalize the calculated Btus, the instantaneous rate in Btus per hour, and store totals in thousands of Btus (MBtu). The Btus calculated shall be totalized for an adjustable time period. The time period shall be defined uniquely for each Btu totalization.

#### 2.15.2.6 Trending

Any analog or calculated point shall be operator assignable to the trend program. Up to eight points shall be sampled at individually assigned intervals, selectable between one minute and two hours. A minimum of the most recent 128 samples of each trended point shall be stored. The sample intervals shall be able to be defined, modified, or deleted on-line.

#### 2.15.3 I/O Point Database/Parameter Definition

Each I/O point shall be defined in a database residing in the DDC. The definition shall include all physical parameters associated with each point. Each point shall be defined and entered into the database by the Contractor, including as applicable:

- a. Name.
- b. Device or sensor type (i.e., sensor, control relay, motors).
- c. Point identification number.
- d. Unit.
- e. Building number.
- f. Area.
- g. Island.

- h. DDC number and channel address.
- i. KW (running).
- j. KW (starting).
- k. Sensor range.
- l. Controller range.
- m. Sensor span.
- n. Controller span.
- o. Engineering units conversion (scale factor).
- p. Setpoint (analog).
- q. High reasonableness value (analog).
- r. Low reasonableness value (analog).
- s. High alarm limit differential (return to normal).
- t. Low alarm limit differential (return to normal).
- u. High alarm limit (analog).
- v. Low alarm limit (analog).
- w. Alarm disable time period upon startup or change of setpoint.
- x. Analog change differential (for reporting).
- y. Alarm class and associated primary message text.
- z. High accumulator limit (pulse).
- aa. Status description.
- bb. Run time target.
- cc. Failure mode as specified and shown.
- dd. Constraints as specified.

#### 2.15.4 Alarm Processing

Each DDC shall have alarm processing software for AI, DI, and PA alarms for all real and virtual points connected to that DDC.

##### 2.15.4.1 Digital Alarms Definition

Digital alarms are those abnormal conditions indicated by DIs as specified and shown.

##### 2.15.4.2 Analog Alarms Definition

Analog alarms are those conditions higher or lower than a defined value, as

measured by an AI. Analog readings shall be compared to predefined high and low limits, and alarmed each time a value enters or returns from a limit condition. Unique high and low limits shall be assigned to each analog point in the system. Analog alarm limits shall be stored in the DDC database. Each analog alarm limit shall have an associated unique limit differential specifying the amount by which a variable must return into the proper operating range before being annunciated as a return-to-normal-state. All limits and differentials shall be entered on-line by the operator in limits of the measured variable, without interruption or loss of monitoring of the point concerned. The program shall automatically change the high or low limits or both, of any analog point, based on time scheduled operations as specified, allowing for a time interval before the alarm limit becomes effective. In CPA applications, key the limit to a finite deviation traveling with the setpoint. The system shall automatically suppress analog alarm reporting associated with a digital point when that digital point is turned off.

#### 2.15.4.3 Pulse Accumulator Alarms Definition

Pulse accumulator alarms are those conditions calculated from totalized values of accumulator inputs or PA input rates that are outside defined limits as specified and shown. PA totalized values shall be compared to predefined limits and alarmed each time a value enters a limit condition. Unique limits shall be assigned to each PA point in the system. Limits shall be stored in the DDC database.

#### 2.15.5 Constraints

##### 2.15.5.1 Equipment Constraints Definitions

Each control point in the database shall have DDC resident constraints defined and entered by the Contractor, including as applicable:

- a. Maximum starts (cycles) per hour.
- b. Minimum off time.
- c. Minimum on time.
- d. High limit (value in engineering units).
- e. Low limit (value in engineering units).

##### 2.15.5.2 Constraints Checks

Control devices connected to the system shall have the DDC memory resident constraints checked before each command is issued to insure that no equipment damage will result from improper operation. Each command shall be executed by the DDC only after all constraints checks have been passed. Each command point shall have unique constraints assigned. High and low "reasonableness" values or one differential "rate-of-change" value shall be assigned to each AI. Values outside the reasonableness limits shall be rejected and an alarm message sent to the network control panel or portable workstation/tester. Status changes and analog point values shall be reported to the workstation upon operator request, such as for reports, alphanumeric displays, graphic displays, and application programs. Each individual point shall be capable of being selectively disabled by the operator from a workstation/tester. Disabling a point shall prohibit monitoring and automatic control of that point.

#### 2.15.6 Diagnostics

Each DDC shall have self-test diagnostic routines implemented in firmware. The tests shall include routines that exercise memory. Diagnostic software shall be usable in conjunction with the central workstation/tester and portable workstation/tester. The software shall display messages in English to inform the tester's operator of diagnosed problems.

#### 2.15.7 Summer-Winter Operation Monitoring

The system shall provide software to automatically change the operating parameters, monitoring of alarm limits, and start-stop schedules for each mechanical system from summer to winter and vice-versa. The software shall provide automatic commands to applications programs to coordinate proper summer or winter operation. Change over setpoints shall be operator selectable and settable.

#### 2.15.8 Control Sequences and Control Loops

Sufficient memory shall be provided to implement the requirements specified and shown for each DDC. Specific functions to be implemented are defined in individual system control sequences and database tables shown in the drawings, and shall include, as applicable, the following:

- a. PI Control: This function shall provide proportional control and proportional plus integral control.
- b. Two Position Control: This function shall provide control for a two state device by comparing a set point against a process variable and an established deadband.
- c. Floating Point Control: This function shall exercise control when an error signal exceeds a selected deadband, and shall maintain control until the error is within the deadband limits.
- d. Signal Selection: This function shall allow the selection of the highest or lowest analog value from a group of analog values as the basis of control. The function shall include the ability to cascade analog values so that large numbers of inputs can be reduced to one or two outputs.
- e. Signal Averaging: This function shall allow the mathematical calculation of the average analog value from a group of analog values as the basis of control. The function shall include the ability to "weight" the individual analog values so that the function output can be biased as necessary to achieve proper control.
- f. Reset Function: This function shall develop an AO based on up to two AIs and one operator specified reset schedule.
- g. Cooling/Heating Operation Program: Software shall be provided to change, either automatically or on operator command, the operating parameters, monitoring of alarm limits, and start-stop schedules for each mechanical system where such a change from cooling to heating and vice versa is meaningful. The software shall provide commands to application programs to coordinate cooling or heating mode operation. Software shall automatically switch facilities from cooling to heating, and vice versa, based on schedules or temperatures. All HVAC equipment and systems shall be assigned to the program.

### 2.15.9 Command Priorities

A scheme of priority levels shall be provided to prevent interaction of a command of low priority with a command of higher priority. The system shall require the latest highest priority command addressed to a single point to be stored for a period of time longer than the longest time constraint in the on and off states, insuring that the correct command shall be issued when the time constraint is no longer in effect or report the rejected command. Override commands entered by the operator shall have higher priority than those emanating from applications programs.

### 2.15.10 Resident Application Software

The Contractor shall provide resident applications programs to achieve the sequences of operation, parameters, constraints, and interlocks necessary to provide control of the systems connected to the DDC system. Application programs shall be resident and shall execute in the DDC, and shall coordinate with each other, to insure that no conflicts or contentions remain unresolved. The Contractor shall coordinate the application programs specified with the equipment and controls operation, and other specified requirements. A scheme of priority levels shall be provided to prevent interaction of a command of low priority with a command of higher priority. The system shall require the latest highest priority command addressed to a single point to be stored for a period of time longer than the longest time constraint in the ON and OFF states, insuring that the correct command shall be issued when the time constraint is no longer in effect or the rejected command shall be reported. Override commands entered by the operator shall have higher priority than those emanating from application programs.

#### 2.15.10.1 Program Inputs and Outputs

The Contractor shall select the appropriate program inputs listed for each application program to calculate the required program outputs. Where the specific program inputs are not available, a "default" value or virtual point appropriate for the equipment being controlled and the proposed sequence of operation shall be provided to replace the missing input, thus allowing the application program to operate. AIs to application programs shall have an operator adjustable deadband to preclude short cycling or hunting. Program outputs shall be real analog or digital outputs or logic (virtual) points as required to provide the specified functions. The Contractor shall select the appropriate input and output signals to satisfy the requirements for control of systems as shown.

#### 2.15.10.2 DDC General Conditions

The Contractor shall provide software required to achieve the sequences of operation, parameters, constraints, and interlocks shown. Application software shall be resident in the DDC in addition to any other required software. In the event of a DDC failure, the controlled equipment shall continue to function in the failure mode shown.

#### 2.15.10.3 Scheduled Start/Stop Program

This program shall start and stop equipment based on a time of day schedule for each day of the week, and on a holiday schedule. To eliminate power surges, an operator adjustable time delay shall be provided between consecutive start commands.

## a. Program Inputs:

- (1) Day of week/holiday.
- (2) Time of day.
- (3) Cooling and heating high-low alarm limits.
- (4) Cooling and heating start-stop schedules.
- (5) Cooling or heating mode of operation.
- (6) Equipment status.
- (7) Equipment constraints.
- (8) Consecutive start time delay.

## b. Program Outputs: Start/stop signal.

## 2.15.10.4 Optimum Start/Stop Program

This program shall start and stop equipment as specified for the scheduled start/stop program, but shall include a sliding schedule based on indoor and outdoor air conditions. The program shall take into account the thermal characteristics of the structure, and indoor and outdoor air conditions, using prediction software to determine the minimum time of HVAC system operation needed to satisfy space environmental requirements at the start of the occupied cycle, and determine the earliest time for stopping equipment at the day's end without exceeding space environmental requirements. An adaptive control algorithm shall be utilized to automatically adjust the constants used in the program.

## a. Program Inputs:

- (1) Day of week/holiday.
- (2) Time of day.
- (3) Cooling or heating mode of operation.
- (4) Equipment status.
- (5) Cooling and heating building occupancy schedules.
- (6) Space temperature.
- (7) Building heating constant (operator adjustable and automatically optimized).
- (8) Building cooling constant (operator adjustable and automatically optimized).
- (9) OA temperature.
- (10) Required space temperature at occupancy (heating).
- (11) Required space temperature at occupancy (cooling).

- (12) Equipment constraints.
- (13) Cooling and heating high-low alarm limits.

b. Program Outputs: Start/stop signal.

#### 2.15.10.5 Day-Night Setback Program

The software shall limit the rise or drop of space temperature (or specified fluid temperature) during unoccupied hours. Whenever the space temperature (or specified fluid temperature) is above (or below for heating) the operator assigned temperature limit, the system shall be turned on until the temperature is within the assigned temperature limit.

a. Program Inputs:

- (1) Day of week.
- (2) Time of day.
- (3) Cooling or heating mode of operation.
- (4) Cooling and heating occupancy schedules.
- (5) Equipment status.
- (6) Space temperature (or specified fluid temperature).
- (7) Minimum space temperature (or specified fluid temperature) during unoccupied periods.
- (8) Maximum space temperature (or specified fluid temperature) during unoccupied periods.
- (9) Equipment constraints.

b. Program Outputs: Start/stop signal.

#### 2.15.10.6 Economizer Program I

The software shall reduce the HVAC system cooling requirements when the OA dry bulb temperature is less than the return air temperature. When the OA dry bulb temperature is above the return air temperature or changeover setpoint, the OA dampers, return air dampers, and relief air dampers shall be positioned to provide minimum required OA. When the OA dry bulb temperature is below a changeover setpoint temperature, the OA dampers, return air dampers, and exhaust air dampers shall be positioned to maintain the required mixed air temperature.

a. Program Input:

- (1) Changeover conditions.
- (2) OA dry bulb temperature.
- (3) RA dry bulb temperature.
- (4) Mixed air dry bulb temperature.

(5) Equipment constraints.

b. Program Output: Damper actuator/cooling control signal.

#### 2.15.10.7 Ventilation/Recirculation and Flush Programs

The software shall reduce the HVAC system thermal load for two modes of operation and provide for flushing of the building as follows:

a. Ventilation mode: In this mode, the system shall precool the space prior to building occupancy. When the outside air temperature is lower than the space temperature, the outside air damper and exhaust air damper shall open to their maximum positions and the return air damper shall close to its minimum position.

b. Recirculation mode: In this mode, the system shall preheat the space prior to building occupancy. When the outside air temperature is lower than the space temperature, the outside air damper and the exhaust air damper shall close to their minimum positions and the return air damper shall open to its maximum position.

c. Flush mode: The software shall use the HVAC supply system to provide 100% outside air for ventilation purpose and flush building spaces. The network control panel shall modulate the control valves to maintain the air supply temperature setpoints while the flush program is in effect. The flush mode shall be manually initiated and have the highest priority (it shall override all other programs). The outside air damper and the exhaust air damper shall be closed at other times during unoccupied periods, except for economizer operation during day/night setback periods. For systems without mechanical cooling, this program shall, in addition to the above requirements, act as an economizer. The outside, return, and exhaust air dampers shall be modulated to maintain the required mixed air temperature setpoint. When this program is released, the outside and exhaust air dampers shall return to their minimum positions, and the return air damper shall return to its maximum position.

d. Program Inputs:

- (1) Day of week.
- (2) Time of day.
- (3) Cooling or heating mode of operation.
- (4) Equipment status.
- (5) Cooling and heating occupancy schedules.
- (6) OA dry bulb temperature.
- (7) Space temperature.
- (8) Equipment constraints.

e. Program Output: Damper actuator control signal.

#### 2.15.10.8 Not Used

2.15.10.9 Not Used

2.15.10.10 Not Used

2.15.10.11 Not Used

2.15.10.12 Air Distribution Unitary Controller Software

Software shall be provided for the management and control of the air distribution terminal units. Software shall allow for operator definition of multiple air distribution terminal units as functional groups which may be treated as a single entity; monitoring, alarming and reporting of terminal unit parameters on an individual or group basis; and remote setpoint adjustment on an individual or group basis.

a. Functions:

- (1) Volume control in response to temperature.
- (2) Volume flow limits, minimum and maximum.
- (3) Occupied and unoccupied operation with associated temperature and volume limits.
- (4) Temperature setpoint override.

b. Program Inputs

- (1) Space temperature.
- (2) Space temperature setpoint.
- (3) Space temperature setpoint limits.
- (4) Supply airflow volume.
- (5) Supply airflow volume high and low limits.

c. Program Outputs

- (1) Supply volume by-pass control signal.
- (2) Not Used
- (3) Not Used

2.15.10.13 Heat Pump Program

Heat pump program shall be used for control and monitoring of the heat pump. The software shall select the most efficient compressor or combination of compressors based on operating data to satisfy the cooling load. The program shall prevent the heat pump compressors from going to full load for a predetermined period to allow the system to stabilize, in order to determine the actual cooling load.

a. Program Inputs

- (1) Not Used.
- (2) Not Used.
- (3) Not Used.
- (4) Not Used
- (5) Entering Heat pump cooling water temperatures.
- (6) Leaving Heat pump cooling condenser water temperatures.
- (7) Not Used.
- (8) Not Used.
- (9) Not Used.
- (10) Not Used.
- (11) Not Used.

- (12) Not Used.
- (13) Not Used.
- (14) Not Used.
- (15) Not Used.
- (16) Refrigerant pressure, suction and discharge.
- (17) Equipment constraints.
- (18) Not Used.

b. Program Outputs

- (1) Start/stop signals for heat pump compressors.
- (2) Heat pump cooling water control valve modulation.
- (3) Not Used.
- (4) Not Used.
- (5) Not Used.
- (6) Not Used.

2.15.10.14 Not Used.

2.15.10.15 Not Used.

2.15.10.16 Not Used.

2.15.10.17 Not Used.

2.15.10.18 Hot Water OA Reset Program

The software shall reset the hot water temperature supplied by the boiler or converter in accordance with the OA temperature. The hot water supply temperature shall be reset downward or upward from a fixed temperature proportionally, as a function of OA temperature or other specified independent variable.

a. Program Inputs

- (1) Reset schedule.
- (2) OA dry bulb temperature or other specified independent variable.
- (3) Hot water supply temperature.
- (4) Maximum hot water supply temperature.
- (5) Minimum hot water supply temperature.
- (6) Equipment constraints.

b. Program Output: Valve actuator control signal.

2.15.10.19 Not Used.

The software shall remotely monitor and control boiler operation based on boiler operational data. The program shall monitor inputs and discontinue boiler operation if any monitored point exceeds a predetermined value or changes status incorrectly. The operator shall be able to add or delete individual program input points from the list of points that will discontinue boiler operation.

a. Program Inputs

- (1) Not Used.
- (2) Not Used.
- (3) Not Used.

- (4) Not Used.
- (5) Not Used.
- (6) Not Used.
- (7) Make-up or feed water flow.
- (8) Not Used.
- (9) Not Used.
- (10) Hot water flow.
- (11) Not Used.
- (12) Hot water supply temperature.
- (13) Hot water return temperature.
- (14) Not Used.
- (15) Not Used.
- (16) Not Used.
- (17) Not Used.
- (18) Not Used.
- (19) Not Used.
- (20) Not Used.

b. Program Outputs

- (1) Boiler enable/disable control signal.
- (2) Boiler Alarms Signals.

2.15.10.20 Not Used.

2.15.10.21 Not Used.

2.15.10.22 Not Used.

2.15.10.23 Not Used.

### 3.1 GENERAL INSTALLATION CRITERIA

#### 3.1.1 HVAC Control System

The HVAC control system shall be completely installed and ready for operation. Dielectric isolation shall be provided where dissimilar metals are used for connection and support. Penetrations through and mounting holes in the building exterior shall be made watertight. The HVAC control system installation shall provide clearance for control system maintenance by maintaining access space between coils, access space to mixed-air plenums, and other access space required to calibrate, remove, repair, or replace control system devices. The control system installation shall not interfere with the clearance requirements for mechanical and electrical system maintenance.

#### 3.1.2 Software Installation

Software shall be loaded for an operational system, including databases for all points, operational parameters, and system, command, and application software. The Contractor shall provide original and backup copies of source, excluding the general purpose operating systems and utility programs furnished by computer manufacturers and the non-job-specific proprietary code furnished by the system manufacturer, and object modules for software on each type of media utilized, within 30 days of formal Government acceptance. In addition, a copy of individual floppy disks of software for each DDC panel shall be provided.

#### 3.1.3 Device Mounting Criteria

Devices mounted in or on piping or ductwork, on building surfaces, in mechanical/electrical spaces, or in occupied space ceilings shall be installed in accordance with manufacturer's recommendations and as shown. Control devices to be installed in piping and ductwork shall be provided with required gaskets, flanges, thermal compounds, insulation, piping, fittings, and manual valves for shutoff, equalization, purging, and calibration. Strap-on temperature sensing elements shall not be used except as specified.

#### 3.1.4 Wiring Criteria

Wiring external to control panels, including low-voltage wiring, shall be installed in metallic raceways. Nonmetallic-sheathed cables or metallic-armored cables may be installed in areas permitted by NFPA 70. Wiring shall be installed without splices between control devices and DDC panels. Instrumentation grounding shall be installed as necessary to prevent ground loops, noise, and surges from adversely affecting operation of the system. Ground rods installed by the contractor shall be tested as specified in IEEE Std 142. Cables and conductor wires shall be tagged at both ends, with the identifier shown on the shop drawings. Electrical work shall be as specified in Section 16415A ELECTRICAL WORK, INTERIOR and as shown.

### 3.2 CONTROL SYSTEM INSTALLATION

#### 3.2.1 Damper Actuators

Actuators shall not be mounted in the air stream. Multiple actuators operating a common damper shall be connected to a common drive shaft. Actuators shall be installed so that their action shall seal the damper to the extent required to maintain leakage at or below the specified rate and shall move the blades smoothly.

#### 3.2.2 Local Gauges for Actuators

Pneumatic actuators shall have an accessible and visible receiver gauge installed in the tubing lines at the actuator as shown.

#### 3.2.3 Room Instrument Mounting

Room instruments, such as wall mounted thermostats, shall be mounted 60 inches above the floor unless otherwise shown. Temperature setpoint devices shall be recess mounted.

#### 3.2.4 Freezestats

For each 20 square feet of coil face area, or fraction thereof, a freezestat shall be provided to sense the temperature at the location shown. Manual reset freezestats shall be installed in approved, accessible locations where they can be reset easily. The freezestat sensing element shall be installed in a serpentine pattern.

#### 3.2.5 Averaging Temperature Sensing Elements

Sensing elements shall have a total element minimum length equal to 1 linear foot per square foot of duct cross-sectional area.

#### 3.2.6 Not Used.

3.2.7 Not Used.

3.2.8 Not Used.

3.2.9 Indication Devices Installed in Piping and Liquid Systems

Gauges in piping systems subject to pulsation shall have snubbers. Gauges for steam service shall have pigtail fittings with cock. Thermometers and temperature sensing elements installed in liquid systems shall be installed in thermowells.

3.2.10 Not Used.

### 3.3 CONTROL SEQUENCES OF OPERATION

The control sequences for the HVAC systems equipment shall be as shown on the drawings.

### 3.4 COMMISSIONING PROCEDURES

#### 3.4.1 Evaluations

The Contractor shall make the observations, adjustments, calibrations, measurements, and tests of the control systems, set the time schedule, and make any necessary control system corrections to ensure that the systems function as described in the sequence of operation.

##### 3.4.1.1 Item Check

Signal levels shall be recorded for the extreme positions of each controlled device. An item-by-item check of the sequence of operation requirements shall be performed using Steps 1 through 4 in the specified control system commissioning procedures. Steps 1, 2, and 3 shall be performed with the HVAC system shut down; Step 4 shall be performed after the HVAC systems have been started. External input signals to the DDC system (such as starter auxiliary contacts, and external systems) may be simulated in steps 1, 2, and 3. With each operational mode signal change, DDC system output relay contacts shall be observed to ensure that they function.

##### 3.4.1.2 Weather Dependent Test Procedures

Weather dependent test procedures that cannot be performed by simulation shall be performed in the appropriate climatic season. When simulation is used, the actual results shall be verified in the appropriate season.

##### 3.4.1.3 Two-Point Accuracy Check

A two-point accuracy check of the calibration of each HVAC control system sensing element and transmitter shall be performed by comparing the DDC system readout to the actual value of the variable measured at the sensing element and transmitter or airflow measurement station location. Digital indicating test instruments shall be used, such as digital thermometers, motor-driven psychrometers, and tachometers. The test instruments shall be at least twice as accurate as the specified sensing element-to-DDC system readout accuracy. The calibration of the test instruments shall be traceable to National Institute Of Standards And Technology standards. The

first check point shall be with the HVAC system in the shutdown condition, and the second check point shall be with the HVAC system in an operational condition. Calibration checks shall verify that the sensing element-to-DDC system readout accuracies at two points are within the specified product accuracy tolerances. If not, the device shall be recalibrated or replaced and the calibration check repeated.

#### 3.4.1.4 Insertion and Immersion Temperatures

Insertion temperature and immersion temperature sensing elements and transmitter-to-DDC system readout calibration accuracy shall be checked at one physical location along the axis of the sensing element.

#### 3.4.1.5 Averaging Temperature

Averaging temperature sensing element and transmitter-to-DDC system readout calibration accuracy shall be checked every 2 feet along the axis of the sensing element in the proximity of the sensing element, for a maximum of 10 readings. These readings shall then be averaged.

#### 3.4.2 Space Temperature Controlled Perimeter Radiation

The heating medium shall be turned on, and the thermostat temperature setpoint shall be raised. The valve shall open. The thermostat temperature shall be lowered and the valve shall close. The thermostat shall be set at the setpoint shown.

#### 3.4.3 Unit Heater

The "OFF/AUTO" switch shall be placed in the "OFF" position. Each space thermostat temperature setting shall be turned up so that it makes contact to turn on the unit heater fans. The unit heater fans shall not start. The "OFF/AUTO" switch shall be placed in the "AUTO" position. It shall be ensured that the unit heater fans start. Each space thermostat temperature setting shall be turned down, and the unit heater fans shall stop. The thermostats shall be set at their temperature setpoints. The results of testing of one of each type of unit shall be logged.

#### 3.4.4 Not Used.

#### 3.4.5 Not Used.

#### 3.4.6 Not Used.

#### 3.4.7 Not Used.

#### 3.4.8 Single Building Hydronic Heating with Hot Water Boiler

Steps for installation shall be as follows:

a. Step 1 - System Inspection: The HVAC system shall be observed in its shutdown condition. It shall be verified that power is available where required.

b. Step 2 - Calibration Accuracy Check with HVAC System Shutdown: Readings shall be taken with a digital thermometer at each temperature sensing element location. Each temperature shall be read at the DDC controller, and the thermometer and DDC system readings logged. The calibration accuracy of the sensing element-to-DDC system readout for

outside air temperature and system supply temperature shall be checked.

c. Step 3 - Not Used.

d. Step 4 - Control System Commissioning:

(1) The two-point calibration sensing element-to-DDC system readout accuracy check for the outside air temperature shall be performed. Any necessary software adjustments to setpoints or parameters shall be made to achieve the outside air temperature schedule.

(2) The outside air temperature shall be simulated through an operator entered value to be above the setpoint. It shall be verified that pumps P-1A or P-1B and boiler B-1 stop. A value shall be entered to simulate that the outside air temperature is below the setpoint as shown. It shall be verified that pumps P-1A or P-1B start and boiler B-1 operates.

(3) The run time on P-1A or P-1B (which ever is on lead) shall be simulated to 150 hours and it shall be verified that the lead pump stops and the lag pump starts.

(4) The two-point calibration accuracy check of the sensing element-to-DDC system readout for the hydronic system supply temperature shall be performed. The supply temperature setpoint shall be set for the temperature schedule as shown. Signals of 8 ma and 16 ma shall be sent to the DDC system from the outside air temperature sensor, to verify that the supply temperature setpoint changes to the appropriate values.

3.4.9 Not Used.

3.4.10 Not Used.

3.4.11 Not Used.

3.4.12 Not Used.

3.4.13 Not Used.

3.4.14 Single Zone Control System with Return Fan and By-pass Boxes

Steps for installation shall be as follows:

a. Step 1 - System Inspection: The HVAC system shall be observed in its shutdown condition. The system shall be checked to see that power is available where required; that the outside air damper, relief air damper, and heat pump cooling water control valve are closed; and that the return air damper is open.

b. Step 2 - Calibration Accuracy Check with HVAC System Shutdown: Readings shall be taken with a digital thermometer at each temperature-sensing element location. Each temperature shall be read at the DDC controller, and the thermometer and DDC system readings logged. The calibration accuracy of the sensing element-to-DDC system readout for outside air, return air, mixed air, supply air temperatures shall be checked.

c. Step 3 - Actuator Range Adjustments: A signal shall be applied to the actuator through an operator entered value to the DDC system. The proper operation of the actuators and positioners for all dampers and valves shall be verified. The signal shall be varied from live zero to full range, and it shall be verified that the actuators travel from zero stroke to full stroke within the signal range. It shall be verified that all sequenced and parallel-operated actuators move from zero stroke to full stroke in the proper direction, and move the connected device in the proper direction from one extreme position to the other.

d. Step 4 - Control System Commissioning:

(1) With the fans ready to start and the system in the cooling mode, the system shall be placed in the ventilation delay mode and in the occupied mode, and it shall be verified that supply fan HPU-1 and return fan RAF-1 start. It shall be verified that the outside air and relief air dampers are closed, and the return air damper is open, by artificially changing the mixed air temperature through operator entered values. It shall be verified that the heat pump compressors are under control, by artificially changing the supply air temperatures through operator entered values. The system shall be placed out of the ventilation delay mode through an operator entered value and it shall be verified that the outside air, return air, and relief air dampers come under control, by artificially changing the mixed air temperature.

(2) The control system shall be placed in the minimum outside air mode. It shall be verified that the outside air damper opens to minimum position.

(3) The economizer mode shall be simulated by a change in the outside air temperature and the return air temperature through operator entered values and it shall be verified that the system goes into the economizer mode. The mixed air temperature shall be artificially changed through operator entered values to slightly open the outside air damper and the second point of the two-point calibration accuracy check of sensing element-to-DDC system readout for outside air, return air, and mixed air temperatures shall be performed. The temperature setpoint shall be set as shown.

(4) The two-point calibration sensing element-to-DDC system readout accuracy check for the outside air temperature shall be performed. Any necessary software adjustments shall be made to setpoints or parameters to achieve the outside air temperature schedule as shown.

(5) The two-point calibration accuracy check of sensing element-to-DDC system readout for the supply air temperature shall be performed.

(6) Not Used.

(7) Not Used.

(8) The control system shall be placed in the unoccupied mode, and it shall be verified that the HVAC system shuts down, and the control system assumes the specified shutdown conditions. The space temperature shall be artificially changed to below the night

setback setpoint and it shall be verified that the HVAC system starts; the space temperature shall be artificially changed to above the night setback setpoint, and it shall be verified that the HVAC system stops. The night setback temperature setpoint shall be set as shown.

(9) With the HVAC system running, a filter differential pressure switch input signal shall be simulated at the device. It shall be verified that the filter alarm is initiated. The differential pressure switch shall be set at the setpoint.

(10) With the HVAC system running, a freezestat trip input signal shall be simulated at the device. HVAC system shutdown shall be verified. It shall be verified that a low temperature alarm is initiated. The freezestat shall be set at the setpoint. The HVAC system shall be restarted by manual restart and it shall be verified that the alarm returns to normal.

(11) With the HVAC system running, a smoke detector trip input signal shall be simulated at each detector, and control device actions and interlock functions as described in the Sequence of Operation shall be verified. Simulation shall be performed without false-alarming any Life Safety systems. It shall be verified that the HVAC system shuts down and that the smoke detector alarm is initiated. The detectors shall be reset. HVAC system shall be restarted by manual reset, and it shall be verified that the alarm signal is changed to a return-to-normal signal.

(12) The temperature setpoint of each zone thermostat shall be raised and it shall be verified that each associated set of by-pass box dampers assume their minimum position.

(13) The system shall be placed in the heating mode and steps 1 thru 5, 8 shall be repeated.

(14) With the system still in the heating mode, the temperature setpoint of each zone thermostat shall be lowered and it shall be verified that each associated set of by-pass box dampers assume their minimum position.

3.4.15 Not Used.

3.4.16 Not Used.

3.4.17 Not Used.

3.4.18 Not Used.

3.4.19 Not Used.

3.4.20 Not Used.

3.4.21 Not Used.

3.4.22 Not Used.

3.5 BALANCING, COMMISSIONING, AND TESTING

### 3.5.1 Coordination with HVAC System Balancing

Commissioning of the control system, except for tuning of controllers, shall be performed prior to or simultaneous with HVAC system balancing. The contractor shall tune the HVAC control system after all air system and hydronic system balancing has been completed, minimum damper positions set and a report has been issued.

### 3.5.2 Control System Calibration, Adjustments, and Commissioning

Control system commissioning shall be performed for each HVAC system, using test plans and procedures previously approved by the Government. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform commissioning and testing of the HVAC control system. All instrumentation and controls shall be calibrated and the specified accuracy shall be verified using test equipment with calibration traceable to NIST standards. Wiring shall be tested for continuity and for ground, open, and short circuits. Tubing systems shall be tested for leaks. Mechanical control devices shall be adjusted to operate as specified. HVAC control panels shall be pretested off-site as a functioning assembly ready for field connections, calibration, adjustment, and commissioning of the operational HVAC control system. Control parameters and logic (virtual) points including control loop setpoints, gain constants, and integral constraints, shall be adjusted before the system is placed on line. Communications requirements shall be as indicated. Written notification of any planned commissioning or testing of the HVAC Control systems shall be given to the Government at least 14 calendar days in advance.

### 3.5.3 Performance Verification Test

The Contractor shall demonstrate compliance of the HVAC control system with the contract documents. Using test plans and procedures previously approved by the Government, the Contractor shall demonstrate all physical and functional requirements of the project. The performance verification test shall show, step-by-step, the actions and results demonstrating that the control systems perform in accordance with the sequences of operation. The performance verification test shall not be started until after receipt by the Contractor of written permission by the Government, based on Government approval of the Commissioning Report and completion of balancing. The tests shall not be conducted during scheduled seasonal off periods of base heating and cooling systems.

### 3.5.4 Endurance Test

The endurance test shall be used to demonstrate the specified overall system reliability requirement of the completed system. The endurance test shall not be started until the Government notifies the Contractor in writing that the performance verification test is satisfactorily completed.

The Government may terminate the testing at any time when the system fails to perform as specified. Upon termination of testing by the Government or by the Contractor, the Contractor shall commence an assessment period as described for Phase II. Upon successful completion of the endurance test, the Contractor shall deliver test reports and other documentation as specified to the Government prior to acceptance of the system.

a. Phase I (Testing). The test shall be conducted 24 hours per day, 7 days per week, for 15 consecutive calendar days, including holidays, and the system shall operate as specified. The Contractor shall make no

repairs during this phase of testing unless authorized by the Government in writing.

b. Phase II (Assessment). After the conclusion of Phase I, the Contractor shall identify failures, determine causes of failures, repair failures, and deliver a written report to the Government. The report shall explain in detail the nature of each failure, corrective action taken, results of tests performed, and shall recommend the point at which testing should be resumed. After delivering the written report, the Contractor shall convene a test review meeting at the jobsite to present the results and recommendations to the Government. As a part of this test review meeting, the Contractor shall demonstrate that all failures have been corrected by performing appropriate portions of the performance verification test. Based on the Contractor's report and test review meeting, the Government may require that the Phase I test be totally or partially rerun. After the conclusion of any retesting which the Government may require, the Phase II assessment shall be repeated as if Phase I had just been completed.

### 3.5.5 Posted and Panel Instructions

Posted and Panel Instructions, showing the final installed conditions, shall be provided for each system. The posted instructions shall consist of laminated half-size drawings and shall include the control system schematic, equipment schedule, sequence of operation, wiring diagram, communication network diagram, and valve and damper schedules. The posted instructions shall be permanently affixed, by mechanical means, to a wall near the control panel. Panel instructions shall consist of laminated letter-size sheets and shall include a Routine Maintenance Checklist and as-built configuration check sheets. Panel instructions and one copy of the Operation and Maintenance Manuals, previously described herein, shall be placed inside each control panel or permanently affixed, by mechanical means, to a wall near the panel.

## 3.6 TRAINING

### 3.6.1 Training Course Requirements

A training course shall be conducted for 4 operating staff members designated by the Contracting Officer in the maintenance and operation of the system, including specified hardware and software. The training period, for a total of 32 hours of normal working time, shall be conducted within 30 days after successful completion of the performance verification test. The training course shall be conducted at the project site. Audiovisual equipment and 4 sets of all other training materials and supplies shall be provided. A training day is defined as 8 hours of classroom instruction, including two 15 minute breaks and excluding lunchtime, Monday through Friday, during the daytime shift in effect at the training facility.

### 3.6.2 Training Course Content

For guidance in planning the required instruction, the Contractor shall assume that attendees will have a high school education or equivalent, and are familiar with HVAC systems. The training course shall cover all of the material contained in the Operating and Maintenance Instructions, the layout and location of each HVAC control panel, the layout of one of each type of unitary equipment and the locations of each, the location of each control device external to the panels, the location of the compressed air

station, preventive maintenance, troubleshooting, diagnostics, calibration, adjustment, commissioning, tuning, and repair procedures. Typical systems and similar systems may be treated as a group, with instruction on the physical layout of one such system. The results of the performance verification test and the calibration, adjustment and commissioning report shall be presented as benchmarks of HVAC control system performance by which to measure operation and maintenance effectiveness.

-- End of Section --

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DIVISION 15 - MECHANICAL

SECTION 15990A

TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS

12/01

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## SECTION 15990A

TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS  
12/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1 (1989) National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems

## NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB Procedural Stds (1991) Procedural Standards for Testing Adjusting Balancing of Environmental Systems

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

TAB Schematic Drawings and Report Forms; G-AO

Three copies of the TAB Schematic Drawings and Report Forms, no later than 21 days prior to the start of TAB field measurements.

## SD-03 Product Data

TAB Related HVAC Submittals;

A list of the TAB Related HVAC Submittals, no later than 7 days after the approval of the TAB Specialist.

TAB Procedures; G-AO

Proposed procedures for TAB, submitted with the TAB Schematic Drawings and Report Forms.

Calibration;

List of each instrument to be used during TAB, stating

calibration requirements required or recommended by both the TAB Standard and the instrument manufacturer and the actual calibration history of the instrument, submitted with the TAB Procedures. The calibration history shall include dates calibrated, the qualifications of the calibration laboratory, and the calibration procedures used.

Systems Readiness Check;

Proposed date and time to begin the Systems Readiness Check, no later than 7 days prior to the start of the Systems Readiness Check.

TAB Execution; G-AO

Proposed date and time to begin field measurements, making adjustments, etc., for the TAB Report, submitted with the Systems Readiness Check Report.

TAB Verification; G-AO

Proposed date and time to begin the TAB Verification, submitted with the TAB Report.

SD-06 Test Reports

Design Review Report; G-AO

A copy of the Design Review Report, no later than 14 days after approval of the TAB Firm and the TAB Specialist.

Systems Readiness Check; G-AO

A copy of completed checklists for each system, each signed by the TAB Specialist, at least 7 days prior to the start of TAB Execution. All items in the Systems Readiness Check Report shall be signed by the TAB Specialist and shall bear the seal of the Professional Society or National Association used as the TAB Standard.

TAB Report; G-AO

Three copies of the completed TAB Reports, no later than 7 days after the execution of TAB. All items in the TAB Report shall be signed by the TAB Specialist and shall bear the seal of the Professional Society or National Association used as the TAB Standard.

TAB Verification Report; G-AO

Three copies of the completed TAB Verification Report, no later than 7 days after the execution of TAB Verification. All items in the TAB Verification Report shall be signed by the TAB Specialist and shall bear the seal of the Professional Society or National Association used as the TAB Standard.

SD-07 Certificates

TAB Firm; G-AO

Certification of the proposed TAB Firm's qualifications by either AABC or NEBB to perform the duties specified herein and in other related Sections, no later than 21 days after the Notice to Proceed. The documentation shall include the date that the Certification was initially granted and the date that the current Certification expires. Any lapses in Certification of the proposed TAB Firm or disciplinary action taken by AABC or NEBB against the proposed TAB Firm shall be described in detail.

TAB Specialist; G-AO

Certification of the proposed TAB Specialist's qualifications by either AABC or NEBB to perform the duties specified herein and in other related Sections, no later than 21 days after the Notice to Proceed. The documentation shall include the date that the Certification was initially granted and the date that the current Certification expires. Any lapses in Certification of the proposed TAB Specialist or disciplinary action taken by AABC or NEBB against the proposed TAB Specialist shall be described in detail.

1.3 SIMILAR TERMS

In some instances, terminology differs between the Contract and the TAB Standard primarily because the intent of this Section is to use the industry standards specified, along with additional requirements listed herein to produce optimal results. The following table of similar terms is provided for clarification only. Contract requirements take precedent over the corresponding AABC or NEBB requirements where differences exist.

SIMILAR TERMS

Contract Term	AABC Term	NEBB Term
TAB Standard Systems.	National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems	Procedural Standards for Testing Adjusting Balancing of Environmental
TAB Specialist	TAB Engineer	TAB Supervisor
Systems Readiness Check	Construction Phase Inspection	Field Readiness Check & Preliminary Field Procedures.

1.4 TAB STANDARD

TAB shall be performed in accordance with the requirements of the standard under which the TAB Firm's qualifications are approved, i.e., AABC MN-lor NEBB Procedural Stds, unless otherwise specified herein. All recommendations and suggested practices contained in the TAB Standard shall be considered mandatory. The provisions of the TAB Standard, including checklists, report forms, etc., shall, as nearly as practical, be used to satisfy the Contract requirements. The TAB Standard shall be used for all aspects of TAB, including qualifications for the TAB Firm and Specialist and calibration of TAB instruments. Where the instrument manufacturer

calibration recommendations are more stringent than those listed in the TAB Standard, the manufacturer's recommendations shall be adhered to. All quality assurance provisions of the TAB Standard such as performance guarantees shall be part of this contract. For systems or system components not covered in the TAB Standard, TAB procedures shall be developed by the TAB Specialist. Where new procedures, requirements, etc., applicable to the Contract requirements have been published or adopted by the body responsible for the TAB Standard used (AABC or NEBB), the requirements and recommendations contained in these procedures and requirements shall be considered mandatory.

## 1.5 QUALIFICATIONS

### 1.5.1 TAB Firm

The TAB Firm shall be either a member of AABC or certified by the NEBB and certified in all categories and functions where measurements or performance are specified on the plans and specifications, including TAB of environmental systems, building systems commissioning, and measuring of sound and vibration in environmental systems. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the firm loses subject certification during this period, the Contractor shall immediately notify the Contracting Officer and submit another TAB Firm for approval. Any firm that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections to be performed by the TAB Firm shall be considered invalid if the TAB Firm loses its certification prior to Contract completion and must be performed by an approved successor. These TAB services are to assist the prime Contractor in performing the quality oversight for which it is responsible. The TAB Firm shall be a subcontractor of the prime Contractor, and shall report to and be paid by the prime Contractor.

### 1.5.2 TAB Specialist

The TAB Specialist shall be either a member of AABC or an experienced technician of the Firm certified by the NEBB. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Specialist loses subject certification during this period, the Contractor shall immediately notify the Contracting Officer and submit another TAB Specialist for approval. Any individual that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections performed by the TAB Specialist shall be considered invalid if the TAB Specialist loses its certification prior to Contract completion and must be performed by the approved successor.

## 1.6 TAB SPECIALIST RESPONSIBILITIES

All TAB work specified herein and in related sections shall be performed under the direct guidance of the TAB Specialist. The TAB Specialist shall participate in the commissioning process specified in Section 15995A COMMISSIONING OF HVAC SYSTEMS.

## PART 2 PRODUCTS (Not Applicable)

### PART 3 EXECUTION

#### 3.1 DESIGN REVIEW

The TAB Specialist shall review the Contract Plans and Specifications and advise the Contracting Officer of any deficiencies that would prevent the HVAC systems from effectively operating in accordance with the sequence of operation specified or prevent the effective and accurate TAB of the system. The TAB Specialist shall provide a Design Review Report individually listing each deficiency and the corresponding proposed corrective action necessary for proper system operation.

#### 3.2 TAB RELATED HVAC SUBMITTALS

The TAB Specialist shall prepare a list of the submittals from the Contract Submittal Register that relate to the successful accomplishment of all HVAC TAB. The submittals identified on this list shall be accompanied by a letter of approval signed and dated by the TAB Specialist when submitted to the Government. The TAB Specialist shall also ensure that the location and details of ports, terminals, connections, etc., necessary to perform TAB are identified on the submittals.

#### 3.3 TAB SCHEMATIC DRAWINGS AND REPORT FORMS

A schematic drawing showing each system component, including balancing devices, shall be provided for each system. Each drawing shall be accompanied by a copy of all report forms required by the TAB Standard used for that system. Where applicable, the acceptable range of operation or appropriate setting for each component shall be included on the forms or as an attachment to the forms. The schematic drawings shall identify all testing points and cross reference these points to the report forms and procedures.

#### 3.4 NOT USED

#### 3.5 TESTING, ADJUSTING, AND BALANCING

##### 3.5.1 TAB Procedures

Step by step procedures for each measurement required during TAB Execution shall be provided. The procedures shall be oriented such that there is a separate section for each system. The procedures shall include measures to ensure that each system performs as specified in all operating modes, interactions with other components (such as exhaust fans, kitchen hoods, fume hoods, relief vents, etc.) and systems, and with all seasonal operating differences, diversity, simulated loads, and pressure relationships required.

##### 3.5.2 Systems Readiness Check

The TAB Specialist shall inspect each system to ensure that it is complete, including installation and operation of controls, and that all aspects of the facility that have any bearing on the HVAC systems, including installation of ceilings, walls, windows, doors, and partitions, are complete to the extent that TAB results will not be affected by any detail or touch-up work remaining. The TAB Specialist shall also verify that all items such as ductwork and piping ports, terminals, connections, etc., necessary to perform TAB shall be complete during the Systems Readiness

Check.

### 3.5.3 Preparation of TAB Report

Preparation of the TAB Report shall begin only when the Systems Readiness Report has been approved. The Report shall be oriented so that there is a separate section for each system. The Report shall include a copy of the appropriate approved Schematic Drawings and TAB Related Submittals, such as pump curves, fan curves, etc., along with the completed report forms for each system. The operating points measured during successful TAB Execution and the theoretical operating points listed in the approved submittals shall be marked on the performance curves and tables. Where possible, adjustments shall be made using an "industry standard" technique which would result in the greatest energy savings, such as adjusting the speed of a fan instead of throttling the flow. Any deficiencies outside of the realm of normal adjustments and balancing during TAB Execution shall be noted along with a description of corrective action performed to bring the measurement into the specified range. If, for any reason, the TAB Specialist determines during TAB Execution that any Contract requirement cannot be met, the TAB Specialist shall immediately provide a written description of the deficiency and the corresponding proposed corrective action necessary for proper system operation to the Contracting Officer.

### 3.5.4 TAB Verification

The TAB Specialist shall recheck ten percent of the measurements listed in the Tab Report and prepare a TAB Verification Report. The measurements selected for verification and the individuals that witness the verification will be selected by the Contracting Officer's Representative (COR). The measurements will be recorded in the same manner as required for the TAB Report. All measurements that fall outside the acceptable operating range specified shall be accompanied by an explanation as to why the measurement does not correlate with that listed in the TAB Report and a description of corrective action performed to bring the measurement into the specified range. The TAB Specialist shall update the original TAB report to reflect any changes or differences noted in the TAB verification report and submit the updated TAB report. If over 20 percent of the measurements selected by the COR for verification fall outside of the acceptable operating range specified, the COR will select an additional ten percent for verification. If over 20 percent of the total tested (including both test groups) fall outside of the acceptable range, the TAB Report shall be considered invalid and all contract TAB work shall be repeated beginning with the Systems Readiness Check.

### 3.5.5 Marking of Setting

Following approval of TAB Verification Report, the setting of all HVAC adjustment devices including valves, splitters, and dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time.

### 3.5.6 Identification of Test Ports

The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leakage or to maintain integrity of vapor barrier.

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## 16261A

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16261A

## VARIABLE FREQUENCY DRIVE SYSTEMS UNDER 600 VOLTS

09/02

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

47 CFR 15 Radio Frequency Devices

## INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE Std 519 (1992) Harmonic Control in Electrical Power Systems

IEEE C62.41 (1991) Surge Voltages in Low-Voltage AC Power Circuits

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (1991) Enclosures for Electrical Equipment (1000 Volts Maximum)

NEMA ICS 1 (1993) Industrial Control and Systems

NEMA ICS 3.1 (1990) Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems

NEMA ICS 6 (1993) Industrial Control and Systems Enclosures

NEMA ICS 7 (1993) Industrial Control and Systems Adjustable-Speed Drives

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

## UNDERWRITERS LABORATORIES (UL)

UL 489 (1996; R 1998) Molded-Case Circuit Breakers and Circuit-Breaker Enclosures

UL 508C (1996) Power Conversion Equipment

UL 1449 (1996; rev thru 1999) Transient Voltage Surge Suppressors

## American National Standards Institute (ANSI)

ANSI/ASHRA 135

(1995) A Data Communication Protocol for  
Building Automation and Control Networks

## 1.2 REQUIREMENTS

Section 16415, "Electrical Work Interior" apply to this section with additions and modifications specified herein.

### 1.2.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate equipment that has been in satisfactory operation at least 2 years prior to bid opening. Equipment shall be supported by a service organization. All VFDs of the same type shall all be the product of one manufacturer.

## 1.3 SYSTEM DESCRIPTION

A variable frequency drive (VFD) shall be provided for each motor indicated on the drawings, schedules and specifications. The VFD shall be sized for the motor being driven as recommended by the VFD manufacturer. The VFD shall be suitable for use with energy efficient NEMA motors.

### 1.3.1 Performance Requirements

#### 1.3.1.1 Electromagnetic Interference Suppression

Computing devices, as defined by 47 CFR 15, rules and regulations, shall be certified to comply with the requirements for class A computing devices and labeled as set forth in part 15.

#### 1.3.1.2 Electromechanical and Electrical Components

Electrical and electromechanical components of the Variable Frequency Drive (VFD) shall not cause electromagnetic interference to adjacent electrical or electromechanical equipment while in operation. The equipment shall also not interfere with telephone or other communications equipment and associated wiring.

### 1.3.2 Electrical Requirements

#### 1.3.2.1 Power Line Surge Protection

Control panel shall have transient voltage surge suppression (TVSS) protection, included within the panel to protect the unit from damaging transient voltage surges in accordance with IEEE C62.41. Surge arrestor shall be mounted as near as possible to the incoming power source with a straight line connection without bends and properly wired to all three phases and ground. The TVSS shall be tested in accordance with UL 1449. Fuses shall not be used for surge protection.

#### 1.3.2.2 Sensor and Control Wiring Surge Protection

I/O functions as specified shall be protected against surges induced on control and sensor wiring installed outdoors. The inputs and outputs shall be tested in both normal mode and common mode using the following two waveforms:

- a. A 10 microsecond by 1000 microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
- b. An 8 microsecond by 20 microsecond waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.

### 1.3.3 Special Environments

#### 1.3.3.1 Weatherproof Locations

Equipment in designated locations shall conform to NFPA 70 requirements for installation in damp or wet locations.

#### 1.3.4 Service Conditions

Items provided under this section shall be specifically suitable for the following service conditions.

- a. Altitude 2070 feet
- b. Ambient Temperature -18 degrees F to 890 degrees F

#### 1.3.5 Manufacturers Service

The contractor shall obtain the services of a manufacturer's representative experienced in the installation adjustment and operation of the equipment specified. The representative shall supervise the installation adjustment and test of the equipment. Up to four days of service shall be provided at no additional cost to the government.

### 1.4 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

#### SD-02 Shop Drawings

Schematic diagrams; G-DO

Interconnecting diagrams; G-DO

Installation drawings; G-AO

Submit drawings for government approval prior to equipment construction or integration. Modifications to original drawings made during installation shall be immediately recorded for inclusion into the as-built drawings.

#### SD-03 Product Data

Variable frequency drives; G-DO

Wires and cables; G-DO

Equipment schedule; G-DO

Include data indicating compatibility with motors being driven.

#### SD-06 Test Reports

VFD Test; G-AO

Test Plan; G-AO

Performance Verification Tests; G-AO

Endurance Test; G-AO

#### SD-08 Manufacturer's Instructions

Installation instructions; G-AO

#### SD-09 Manufacturer's Field Reports

VFD Factory Test Plan; G-AO

Total Harmonic Distortion Analysis; G-AO

#### SD-10 Operation and Maintenance Data

Variable frequency drives; G-AO, Data Package

Submit operation and maintenance manuals in accordance with Section 01781, "Operation and Maintenance Data." Provide service and maintenance information including preventive maintenance, assembly, and disassembly procedures. Submit additional information necessary to provide complete operation, repair, and maintenance information, detailed to the smallest replaceable unit. Include copies of as-built submittals. Provide routine preventative maintenance instructions, and equipment required. Provide instructions on how to modify program settings, and modify the control program. Provide instructions on drive adjustment, trouble-shooting, and configuration. Provide instructions on process tuning and system calibration.

### 1.5 QUALITY ASSURANCE

#### 1.5.1 Schematic Diagrams

Show circuits and device elements for each replaceable module. Schematic diagrams of printed circuit boards are permitted to group functional assemblies as devices, provided that sufficient information is provided for government maintenance personnel to verify proper operation of the functional assemblies.

#### 1.5.2 Interconnecting Diagrams

Show interconnections between equipment assemblies, and external interfaces, including power and signal conductors. Include for enclosures and external devices.

#### 1.5.3 Installation Drawings

Show floor plan of each site, with V.F.D.'s and motors indicated. Indicate ventilation requirements, adequate clearances, and cable routes.

#### 1.5.4 Equipment Schedule

Provide schedule of equipment supplied. Schedule shall provide a cross reference between manufacturer data and identifiers indicated in shop drawings. Schedule shall include the total quantity of each item of equipment supplied. For complete assemblies, such as VFD's, provide the serial numbers of each assembly, and a sub-schedule of components within the assembly. Provide recommended spare parts listing for each assembly or component.

#### 1.5.5 Installation instructions

Provide installation instructions issued by the manufacturer of the equipment, including notes and recommendations, prior to shipment to the site. Provide operation instructions prior to acceptance testing.

#### 1.6 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

#### 1.7 WARRANTY

The complete system shall be warranted by the manufacturer for a period of one year. Any component failing to perform its function as specified and documented shall be repaired or replaced by the contractor at no additional cost to the Government. Items repaired or replaced shall be warranted for an additional period of at least one year from the date that it becomes functional again, as specified in the FAR CLAUSE 52.246-21.

#### 1.8 MAINTENANCE

##### 1.8.1 Spare Parts

Manufacturers shall provide spare parts in accordance with manufacturer's recommended spare parts list.

##### 1.8.2 Maintenance Support

During the warranty period, the Contractor shall provide on-site, on-call maintenance services by Contractor's personnel on the following basis: The service shall be on a per-call basis with 36 hour response. Contractor shall support the maintenance of all hardware and software of the system. Various personnel of different expertise shall be sent on-site depending on the nature of the maintenance service required. Costs shall include travel, local transportation, living expenses, and labor rates of the service personnel while responding to the service request. The provisions of this Section are not in lieu of, nor relieve the Contractor of, warranty responsibilities covered in this specification. Should the result of the service request be the uncovering of a system defect covered under the warranty provisions, all costs for the call, including the labor necessary to identify the defect, shall be borne by the Contractor.

### PART 2 PRODUCTS

#### 2.1 VARIABLE FREQUENCY DRIVES (VFD)

Provide frequency drive to control the speed of induction motor(s). The motor(s) being controlled are energy efficient NEMA motors. The VFD shall include the following minimum functions, features and ratings.

- a. Input circuit breaker per UL 489 with a minimum of 14,000 amps symmetrical interrupting capacity and through-the-door interlocked external operator with provisions for padlocking. The circuit breakers shall provide a positive disconnect between the controller and all phases of the incoming A-C line.
- b. A converter stage per UL 508C shall change fixed voltage, fixed frequency, ac line power to a fixed dc voltage. The converter shall utilize a full wave bridge design incorporating diode rectifiers. Silicon Controlled Rectifiers (SCR) are not acceptable. The bridge rectifier design shall be a 18 pulse design. The converter shall be insensitive to three phase rotation of the ac line and shall not cause displacement power factor of less than .95 lagging under any speed and load condition.
- c. An inverter stage shall change fixed dc voltage to variable frequency, variable voltage, ac for application to a standard NEMA design B squirrel cage motor. The inverter shall utilize insulated gate bipolar transistors (IGBT) (SCR's, GTO's and Darlington transistors are not acceptable) and shall produce a sine coded pulse width modulated (PWM) output waveform.
- d. The VFD shall be capable of supplying 120 percent of rated full load current for one minute at maximum ambient temperature.
- e. The VFD shall be designed to operate from a 480 volt, + or - 10 percent, three phase, 60 Hz supply, and control motors with a corresponding voltage rating. See motor information located in section 16415, Electrical Work Interior.
- f. Acceleration and deceleration time shall be independently adjustable from 1 second to 120 seconds.
- g. Adjustable full-time current limiting shall limit the current to a preset value which shall not exceed 110 percent of the controller rated current. The current limiting action shall maintain the V/Hz ratio constant so that variable torque can be maintained. Short time starting override shall allow starting current to reach 150 percent of controller rated current to maximum starting torque.
- h. The controllers shall be capable of producing an output frequency over the range of 3Hz to 60 Hz (20 to one speed range), without low speed cogging. Over frequency protection shall be included such that a failure in the controller electronic circuitry shall not cause frequency to exceed 110 percent of the maximum controller output frequency selected.
- i. Minimum and maximum output frequency shall be adjustable over the following ranges: 1) Minimum frequency 3 Hz to 50 percent of maximum selected frequency; 2) Maximum frequency 40 Hz to 60 Hz.
- j. The controller efficiency at any speed shall not be less than 96 percent.
- k. The controllers shall be capable of being restarted into a motor coasting in the forward direction without tripping.
- l. Protection of power semiconductor components shall be accomplished

without the use of fast acting semiconductor output fuses. Subjecting the controllers to any of the following conditions shall not result in component failure or the need for fuse replacement:

1. Short circuit at controller output
  2. Ground fault at controller output
  3. Open circuit at controller output
  4. Input undervoltage
  5. Input overvoltage
  6. Loss of input phase
  7. AC line switching transients
  8. Instantaneous overload
  9. Sustained overload exceeding 115 percent of controller rated current
  10. Over temperature
  11. Phase reversal
- m. Solid state motor overload protection shall be included such that current exceeding an adjustable threshold shall activate a 60 second timing circuit. Should current remain above the threshold continuously for the timing period, the controller shall automatically shut down.
- n. A slip compensation circuit shall be included which will sense changing motor load conditions and adjust output frequency to provide speed regulation of NEMA B motors to within + / - 0.5 percent of maximum speed without the necessity of a tachometer generator.
- o. The VFD shall be factory set for manual restart after the first protective circuit trip for malfunction (overcurrent, undervoltage, overvoltage or overtemperature) or an interruption of power. The VFD shall be capable of being set for automatic restart after a selected time delay. If the drive faults again within a specified time period (adjustable 0-60 seconds), a manual restart will be required. The number of automatic restarts after a selectable time delay shall be programmable. After the programmed number of automatic restarts has been exhausted and the drive faults again, a manual restart will be required.
- p. The VFD shall include external fault reset capability. All the necessary logic to accept an external fault reset contact shall be included.
- q. Provide critical speed lockout circuitry to prevent operating at frequencies with critical harmonics that cause resonant vibrations. The VFD shall have a minimum of three user selectable bandwidths.

- r. Provide the following operator control and monitoring devices mounted on the front panel of the VFD:
  - 1. Manual speed potentiometer.
  - 2. Hand-Off-Auto ( HOA ) switch.
  - 3. Power on light.
  - 4. Drive run power light.
  - 5. Local display. The local display shall be a backlit LCD display(LED is unacceptable). The display shall be capable of displaying 6 lines of text 21 alphanumeric characters long. All text messages and output shall be displayed in plain English (code numbers and letters are not acceptable).
  - 6. Touch Digital Keypad. The touch digital keypad shall be ruggedized for use in an industrial setting. The keypad shall be lockable using a keyed selector switch. The keypad shall consist of programmable function keys and arrow keys. The function keys and arrow keys shall be used to program the VFD or to make changes to existing settings using menus. The keypad shall also be used to access output information. As a minimum the following outputs shall be displayed:
    - a. speed reference
    - b. output frequency
    - c. output current
    - d. motor torque
    - e. output power
    - f. output voltage
    - g. line voltage
    - h. DC voltage
    - i. motor speed
- s. Provide properly sized NEMA rated by-pass and isolation contactors to enable operation of motor in the event of VFD failure. Mechanical and electrical interlocks shall be installed between the by-pass and isolation contactors. Provide a selector switch and transfer delay timer.
- t. The output carrier frequency shall be randomly modulated and selectable at 2,4, and 10 kHz depending on the drive rating for low noise operation. No drive with an operable carrier frequency above 10kHz shall be allowed.
- u. A user interface shall be provided that will operate with a WINDOWS based personal computer with a serial link,will also have an EIA-485 and EIA-232 port.

- v. Isolated process control interface, where indicated, shall enable the controller to follow a 4-20mA and 0-10 VD-Cgrounded signal from a process controller.
- w. Output contactor shall provide a positive disconnect (contactor) between the output terminals of the controller and the motor being controlled. When a stop or coast to rest command is initiated, the contactor shall immediately open. If the the ramp to rest command is initiated, the controller shall first bring the motor to a controlled stop and then the contactor shall open. In either mode of operation, when a start command in initiated, the contactor shall first close prior to the converter and inverter sections beginning operation.
- x. Auxiliary output contacts shall be provided to indicate "ON", "OFF" and "TRIP" .

## 2.2 ENCLOSURES

Provide NEMA lequipment enclosures conforming to NEMA 250, NEMA ICS 7, NEMA ICS 6.

## 2.3 WIRES AND CABLES

All wires and cables shall conform to NEMA 250, NEMA ICS 7, NFPA 70.

## 2.4 NAMEPLATES

Nameplates external to NEMA enclosures shall conform with the requirements of Section 16415, "Electrical Work Interior." Nameplates internal to enclosures shall be manufacturer's standard, with the exception that they must be permanent.

## 2.5 SOURCE QUALITY CONTROL

### 2.5.1 Total Harmonic Distortion Analysis

A total harmonic distortion analysis shall be performed by the VFD provider. The harmonic analysis shall shall be done for the point of common coupling (PCC) as defined by IEEE 519. The PCC shall be submitted a part of the total harmonic distortion analysis for approval by the contracting officer. The analysis shall be based on the one-line diagram, distribution transformer data (kVA %Z and X/R ratio) and emergency generator performance specification information provided by the contractor. If the calculations determine that the total harmonic distortion (THD) are greater than 3 percent a properly sized line reactor shall be provided on the input side of the VFD.

## 2.6 Diagnostic Equipment

The VFD manufacturer and/or contractor shall provide the government with one diagnostic tester/analyzer for use with controllers. The test/analyzer shall provide a quick means for monitoring and diagnosing the drive and isolating a problem down to a sub-assembly.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Per NEMA ICS 3.1, install equipment in accordance with the approved manufacturer's printed installation drawings, instructions, wiring diagrams, and as indicated on project drawings and the approved shop drawings. A field representative of the drive manufacturer shall supervise the installation of all equipment and wiring.

### 3.1.1 VFD Output Side Line Reactors and Path Shaping Termination Circuits

Provide reactors of path shaping termination circuits or both, as necessary between the individual drives and the motors such that the peak voltage at the motor terminals during all ranges of operation is less than the motor insulating rating of the motor being controlled.

## 3.2 FIELD QUALITY CONTROL

Specified products shall be tested as a system for conformance to specification requirements prior to scheduling the acceptance tests. Contractor shall conduct performance verification tests in the presence of Government representative, observing and documenting complete compliance of the system to the specifications. Contractor shall submit a signed copy of the test results, certifying proper system operation before scheduling tests.

### 3.2.1 VFD Test

A proposed test plan shall be submitted to the contracting officer at least 28 calendar days prior to proposed testing for approval. The tests shall conform to NEMA ICS 1, NEMA ICS 7, and all manufacturer's safety regulations. The Government reserves the right to witness all tests and review any documentation. The contractor shall inform the Government at least 14 working days prior to the dates of testing. Contractor shall provide video tapes, if available, of all training provided to the Government for subsequent use in training new personnel. All training aids, texts, and expendable support material for a self-sufficient presentation shall be provided for four students.

### 3.2.2 Performance Verification Tests

"Performance Verification Test" plan shall provide the step by step procedure required to establish formal verification of the performance of the VFD. Compliance with the specification requirements shall be verified by inspections, review of critical data, demonstrations, and tests. The Government reserves the right to witness all tests, review data, and request other such additional inspections and repeat tests as necessary to ensure that the system and provided services conform to the stated requirements. The contractor shall inform the Government 14 calendar days prior to the date the test is to be conducted.

## 3.3 Field Painting

Stainless steel, galvanized steel, and nonferrous surfaces shall not be painted.

### 3.3.1 Touch-Up Painting

Factory painted items requiring touching up in the field shall be thoroughly cleaned of all foreign material and shall be primed and

topcoated with the manufacturer's standard factory finish.

### 3.3.2 Exposed Ferrous Surfaces

Exposed ferrous surfaces shall be painted with two coats of enamel paint. Factory primed surfaces shall be solvent-cleaned before painting. Surfaces that have not been factory primed shall be prepared and primed in accordance with the enamel paint manufacturer's recommendations.

## 3.4 Training

### 3.4.1 General

Provide the services of competent instructors who will give full instruction to designated personnel in operation, maintenance, calibration, configuration, and programming of the complete control system. Orient the training specifically to the system installed. Instructors shall be thoroughly familiar with the subject matter they are to teach. The Government personnel designated to attend the training will have a high school education or equivalent. The number of training days of instruction furnished shall be as specified below. A training day is defined as eight hours of instruction, including two 15-minute breaks and excluding lunch time; Monday through Friday. Provide a training manual for each student at each training phase which describes in detail the material included in each training program. Provide one additional copy for archiving. Provide equipment and materials required for classroom training. Provide a list of additional related courses, and offers, noting any courses recommended. List each training course individually by name, including duration, approximate cost per person, and location of course. Unused copies of training manuals shall be turned over to the Government at the end of last training session.

#### 3.4.1.1 Operating Personnel Training Program

Provide one 2 hour training session at the site at a time and place designated by the Government. Provide session to train 4 operation personnel in the functional operations of the system and the procedures that personnel will follow in system operation. This training shall include:

- a. System overview
- b. General theory of operation
- c. System operation
- d. Alarm formats
- e. Failure recovery procedures
- f. Troubleshooting

#### 3.4.1.2 Engineering/Maintenance Personnel Training

Training shall be conducted on site at a time and location designated by the Government. Provide a one day training session to train 4 engineering personnel in the functional operations of the system. This training shall include:

- a. System overview
  - b. General theory of operation
  - c. System operation
  - d. System configuration
  - e. Alarm formats
  - f. Failure recovery procedures
  - g. Troubleshooting and repair
  - h. Maintenance and calibration
  - i. System programming and configuration
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## SECTION 16375A

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## SECTION 16375A

ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND  
02/02

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C119.1	(1986; R 1997) Sealed Insulated Underground Connector Systems Rated 600 Volts
ANSI C12.10	(1997) Electromechanical Watthour Meters
ANSI C12.11	(1987; R 1993) Instrument Transformers for Revenue Metering, 10 kV BIL through 350 kV BIL (0.6 kV NSV through 69 kV NSV)
ANSI C12.4	(1984; R 1996) Mechanical Demand Registers
ANSI C135.30	(1988) Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction
ANSI C29.1	(1988; R 1996) Electrical Power Insulators - Test Methods
ANSI C37.121	(1989; R 1995) Switchgear, Unit Substations Requirements
ANSI C37.16	(2000) Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors - Preferred Ratings, Related Requirements, and Application Recommendations
ANSI C37.46	(1981; R 1992) Power Fuses and Fuse Disconnecting Switches
ANSI C37.50	(1989; R 1995) Switchgear, Low-Voltage AC Power Circuit Breakers Used in Enclosures - Test Procedures
ANSI C37.72	(1987) Manually-Operated, Dead-Front Padmounted Switchgear with Load Interrupting Switches and Separable Connectors for Alternating-Current Systems
ANSI C57.12.13	(1982) Conformance Requirements for Liquid-Filled Transformers Used in Unit Installations, Including Unit Substations

ANSI C57.12.21	(1995) Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Single-Phase Distribution Transformers with High-Voltage Bushings; (High-Voltage, 34 500 Grd Y/19 920 Volts and Below; Low-Voltage, 240/120; 167 kVA and Smaller)
ANSI C57.12.26	(1993) Pad-Mounted Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers for Use with Separable Insulated High-Voltage Connectors, High-Voltage, 34 500 Grd Y/19 920 Volts and Below; 2500 kVA and Smaller
ANSI C57.12.27	(1982) Conformance Requirements for Liquid-Filled Distribution Transformers Used in Pad-Mounted Installations, Including Unit Substations
ANSI C57.12.28	(1999) Switchgear and Transformers - Padmounted Equipment - Enclosure Integrity
ANSI C80.1	(1995) Rigid Steel Conduit - Zinc Coated
ANSI O5.1	(1992) Specifications and Dimensions for Wood Poles

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123/A 123M	(2001) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(2001) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 48	(1994ae1) Gray Iron Castings
ASTM A 48M	(1994e1) Gray Iron Castings (Metric)
ASTM B 117	(1997) Operating Salt Spray (Fog) Apparatus
ASTM B 231/B 231M	(1999) Concentric-Lay-Stranded Aluminum 1350 Conductors
ASTM B 3	(1995) Soft or Annealed Copper Wire
ASTM B 400	(1994) Compact Round Concentric-Lay-Stranded Aluminum 1350 Conductor
ASTM B 496	(1999) Compact Round Concentric-Lay-Stranded Copper Conductors
ASTM B 609/B 609M	(1999) Aluminum 1350 Round Wire, Annealed and Intermediate Tempers, for Electrical purposes
ASTM B 8	(1999) Concentric-Lay-Stranded Copper

	Conductors, Hard, Medium-Hard, or Soft
ASTM B 800	(2000) 8000 Series Aluminum Alloy Wire for Electrical Purposes-Annealed and Intermediate Tempers
ASTM B 801	(1999) Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation
ASTM C 478	(1997) Precast Reinforced Concrete Manhole Sections
ASTM C 478M	(1997) Precast Reinforced Concrete Manhole Sections (Metric)
ASTM D 1654	(1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 2472	(2000) Sulfur Hexafluoride
ASTM D 4059	(1996) Analysis of Polychlorinated Biphenyls in Insulating Liquids by Gas Chromatography
ASTM D 923	(1997) Sampling Electrical Insulating Liquids

## ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)

AEIC CS5	(1994; CS5a-1995) Cross-Linked Polyethylene Insulated Shielded Power Cables Rated 5 Through 46 kV
AEIC CS6	(1996) Ethylene Propylene Rubber Insulated Shielded Power Cables Rated 5 Through 69 kV

## FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825a	(1998) Approval Guide Fire Protection
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## INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(1997) National Electrical Safety Code
IEEE C37.1	(1994) IEEE Standard Definition, Specification, and Analysis of Systems Used for Supervisory Control, Data Acquisition, and Automatic Control
IEEE C37.13	(1990; R 1995) Low-Voltage AC Power Circuit Breakers Used in Enclosures
IEEE C37.2	(1996) Electrical Power System Device Function Numbers and Contact Designations
IEEE C37.20.1	(1993) Metal-Enclosed Low-Voltage Power Circuit-Breaker Switchgear

IEEE C37.20.2	(1993; C37.20.2b) Metal-Clad and Station-Type Cubicle Switchgear
IEEE C37.20.3	(1997) Metal-Enclosed Interrupter Switchgear
IEEE C37.23	(1987; R 1991) Guide for Metal-Enclosed Bus and Calculating Losses in Isolated-Phase Bus
IEEE C37.30	(1997) Requirements for High-Voltage Switches
IEEE C37.34	(1994) Test Code for High-Voltage Air Switches
IEEE C37.41	(1994; C37.41c) Design Tests for High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories
IEEE C37.63	(1997) Requirements for Overhead, Pad-Mounted, Dry-Vault, and Submersible Automatic Line Sectionalizer for AC Systems
IEEE C37.90	(1989; R 1994) Relays and Relay Systems Associated with Electric Power Apparatus
IEEE C37.90.1	(1989; R 1994) IEEE Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems
IEEE C37.98	(1987; R 1991) Seismic Testing of Relays
IEEE C57.12.00	(1993) Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
IEEE C57.13	(1993) Instrument Transformers
IEEE C57.98	(1993) Guide for Transformer Impulse Tests \\\\$avail only as part of Distribution, Power, and Regulating Transformers Stds Collection
IEEE C62.1	(1989; R 1994) Surge Arresters for AC Power Circuits
IEEE C62.11	(1999) IEEE Standard Metal-Oxide Surge Arresters for AC Power Circuits
IEEE C62.2	(1987; R 1994) Guide for the Application of Gapped Silicon-Carbide Surge Arresters for Alternating Current Systems
IEEE Std 100	(1997) IEEE Standard Dictionary of Electrical and Electronics Terms

IEEE Std 242	(1986; R 1991) Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
IEEE Std 386	(1995) Separable Insulated Connector Systems for Power Distribution Systems Above 600V
IEEE Std 399	(1997) Recommended Practice for Industrial and Commercial Power Systems Analysis
IEEE Std 404	(1993) Cable Joints for Use with Extruded Dielectric Cable Rated 5000 V Through 138 000 V and Cable Joints for Use with Laminated Dielectric Cable Rated 2500 V Through 500 000 V
IEEE Std 48	(1998) Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV
IEEE Std 592	(1990; R 1996) Exposed Semiconducting Shields on Premolded High Voltage Cable Joints and Separable Insulated Connectors
IEEE Std 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1) \\\\$31.00\$\\F

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA AB 1	(1993) Molded Case Circuit Breakers and Molded Case Switches
NEMA BU 1	(1994) Busways
NEMA FB 1	(1993) Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies
NEMA FU 1	(1986) Low Voltage Cartridge Fuses
NEMA LA 1	(1992) Surge Arresters
NEMA PB 1	(1995) Panelboards
NEMA PB 2	(1995) Deadfront Distribution Switchboards
NEMA SG 2	(1993) High Voltage Fuses
NEMA SG 3	(1995) Power Switching Equipment
NEMA SG 5	(1995) Power Switchgear Assemblies
NEMA TC 5	(1990) Corrugated Polyolefin Coilable Plastic Utilities Duct
NEMA TC 6	(1990) PVC and ABS Plastic Utilities Duct

## for Underground Installation

- NEMA TC 7 (1990) Smooth-Wall Coilable Polyethylene Electrical Plastic Duct
- NEMA WC 7 (1988; Rev 3 1996) Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
- NEMA WC 8 (1988; Rev 3 1996) Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 70 (2002) National Electrical Code

## UNDERWRITERS LABORATORIES (UL)

- UL 1072 (1995; Rev Mar 1998) Medium Voltage Power Cables
- UL 1242 (1996; Rev Mar 1998) Intermediate Metal Conduit
- UL 1684 (2000) Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
- UL 198C (1986; Rev thru Feb 1998) High-Interrupting-Capacity Fuses, Current-Limiting Types
- UL 198D (1995) Class K Fuses
- UL 198E (1988; Rev Jul 1988) Class R Fuses
- UL 198H (1988; Rev thru Nov 1993) Class T Fuses
- UL 467 (1993; Rev thru Apr 1999) Grounding and Bonding Equipment
- UL 486A (1997; Rev thru Dec 1998) Wire Connectors and Soldering Lugs for Use with Copper Conductors
- UL 486B (1997; Rev Jun 1997) Wire Connectors for Use with Aluminum Conductors
- UL 489 (1996; Rev thru Dec 1998) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
- UL 510 (1994; Rev thru Apr 1998) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape
- UL 514A (1996; Rev Dec 1999) Metallic Outlet Boxes

UL 6	(1997) Rigid Metal Conduit
UL 651	(1995; Rev thru Oct 1998) Schedule 40 and 80 Rigid PVC Conduit
UL 854	(1996; Rev Oct 1999) Service-Entrance Cables
UL 857	(1994; Rev thru Dec 1999) Busways and Associated Fittings

## 1.2 GENERAL REQUIREMENTS

### 1.2.1 Terminology

Terminology used in this specification is as defined in IEEE Std 100.

### 1.2.2 Service Conditions

Items provided under this section shall be specifically suitable for the following service conditions.

- a. Altitude 2070 feet
- b. Ambient Temperature Minus 18 degrees F to 89 degrees f

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

#### Electrical Distribution System; G-DO

Detail drawings consisting of equipment drawings, illustrations, schedules, instructions, diagrams manufacturers standard installation drawings and other information necessary to define the installation and enable the Government to check conformity with the requirements of the contract drawings.

If departures from the contract drawings are deemed necessary by the Contractor, complete details of such departures shall be included with the detail drawings. Approved departures shall be made at no additional cost to the Government.

Detail drawings shall show how components are assembled, function together and how they will be installed on the project. Data and drawings for component parts of an item or system shall be coordinated and submitted as a unit. Data and drawings shall be coordinated and included in a single submission. Multiple submissions for the same equipment or system are not acceptable except where prior approval has been obtained from the Contracting Officer. In such cases, a list of data to be submitted later shall be included with the first submission. Detail drawings

shall consist of the following:

a. Detail drawings showing physical arrangement, construction details, connections, finishes, materials used in fabrication, provisions for conduit or busway entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and equipment weight. Drawings shall be drawn to scale and/or dimensioned. All optional items shall be clearly identified as included or excluded.

b. Internal wiring diagrams of equipment showing wiring as actually provided for this project. External wiring connections shall be clearly identified.

Detail drawings shall as a minimum depict the installation of the following items:

a. Medium-voltage cables and accessories including cable installation plan.

b. Transformers.

c. Switchgear.

d. Pad-mounted Transformer.

e. Surge arresters.

#### SD-03 Product Data

Fault Current Analysis; G-DO  
Protective Device; G-DO  
Coordination Study; G-DO

The study shall be submitted with protective device equipment submittals. No time extension or similar contract modifications will be granted for work arising out of the requirements for this study. Approval of protective devices proposed shall be based on recommendations of this study. The Government shall not be held responsible for any changes to equipment, device ratings, settings, or additional labor for installation of equipment or devices ordered and/or procured prior to approval of the study.

Nameplates; G-AO

Catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.

Material and Equipment; G-AO

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each entry shall include an item number, the quantity of items proposed, and the name of the manufacturer of each such item.

General Installation Requirements; G-AO

As a minimum, installation procedures for transformers,

substations, switchgear, and medium-voltage cable terminations and splices.

Procedures shall include cable pulling plans, diagrams, instructions, and precautions required to install, adjust, calibrate, and test the devices and equipment.

#### SD-06 Test Reports

##### Field Testing; G-AO

A proposed field test plan, 20 days prior to testing the installed system. No field test shall be performed until the test plan is approved. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits.

##### Operating Tests; G-AO

Six copies of the information described below in 8-1/2 by 11 inch binders having a minimum of three rings, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

- a. A list of equipment used, with calibration certifications.
- b. A copy of measurements taken.
- c. The dates of testing.
- d. The equipment and values to be verified.
- e. The condition specified for the test.
- f. The test results, signed and dated.
- g. A description of adjustments made.

##### Cable Installation; G-AO

Six copies of the information described below in 8-1/2 by 11 inch binders having a minimum of three rings from which material may readily be removed and replaced, including a separate section for each cable pull. Sections shall be separated by heavy plastic dividers with tabs, with all data sheets signed and dated by the person supervising the pull.

- a. Site layout drawing with cable pulls numerically identified.
- b. A list of equipment used, with calibration certifications. The manufacturer and quantity of lubricant used on pull.
- c. The cable manufacturer and type of cable.
- d. The dates of cable pulls, time of day, and ambient temperature.
- e. The length of cable pull and calculated cable pulling tensions.

- f. The actual cable pulling tensions encountered during pull.

#### SD-07 Certificates

##### Material and Equipment; G-A0

Where materials or equipment are specified to conform to the standards of the Underwriters Laboratories (UL) or to be constructed or tested, or both, in accordance with the standards of the American National Standards Institute (ANSI), the Institute of Electrical and Electronics Engineers (IEEE), or the National Electrical Manufacturers Association (NEMA), the Contractor shall submit proof that the items provided conform to such requirements.

The label of, or listing by, UL will be acceptable as evidence that the items conform. Either a certification or a published catalog specification data statement, to the effect that the item is in accordance with the referenced ANSI or IEEE standard, will be acceptable as evidence that the item conforms. A similar certification or published catalog specification data statement to the effect that the item is in accordance with the referenced NEMA standard, by a company listed as a member company of NEMA, will be acceptable as evidence that the item conforms. In lieu of such certification or published data, the Contractor may submit a certificate from a recognized testing agency equipped and competent to perform such services, stating that the items have been tested and that they conform to the requirements listed, including methods of testing of the specified agencies. Compliance with above-named requirements does not relieve the Contractor from compliance with any other requirements of the specifications.

##### Cable Joints; G-A0

A certification that contains the names and the qualifications of people recommended to perform the splicing and termination of medium-voltage cables approved for installation under this contract. The certification shall indicate that any person recommended to perform actual splicing and terminations has been adequately trained in the proper techniques and have had at least three recent years of experience in splicing and terminating the same or similar types of cables approved for installation. In addition, any person recommended by the Contractor may be required to perform a practice splice and termination, in the presence of the Contracting Officer, before being approved as a qualified installer of medium-voltage cables. If that additional requirement is imposed, the Contractor shall provide short sections of the approved types of cables along with the approved type of splice and termination kits, and detailed manufacturer's instruction for the proper splicing and termination of the approved cable types.

##### Cable Installer Qualifications; G-A0

The Contractor shall provide at least one onsite person in a supervisory position with a documentable level of competency and experience to supervise all cable pulling operations. A resume shall be provided showing the cable installers' experience in the last three years, including a list of references complete with

points of contact, addresses and telephone numbers.

#### SD-10 Operation and Maintenance Data

##### Electrical Distribution System; G-AO

Six copies of operation and maintenance manuals, within 7 calendar days following the completion of tests and including assembly, installation, operation and maintenance instructions, spare parts data which provides supplier name, current cost, catalog order number, and a recommended list of spare parts to be stocked. Manuals shall also include data outlining detailed procedures for system startup and operation, and a troubleshooting guide which lists possible operational problems and corrective action to be taken. A brief description of all equipment, basic operating features, and routine maintenance requirements shall also be included. Documents shall be bound in a binder marked or identified on the spine and front cover. A table of contents page shall be included and marked with pertinent contract information and contents of the manual. Tabs shall be provided to separate different types of documents, such as catalog ordering information, drawings, instructions, and spare parts data. Index sheets shall be provided for each section of the manual when warranted by the quantity of documents included under separate tabs or dividers.

Three additional copies of the instructions manual shall be provided within 30 calendar days following the manuals.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

Devices and equipment shall be visually inspected by the Contractor when received and prior to acceptance from conveyance. Stored items shall be protected from the environment in accordance with the manufacturer's published instructions. Damaged items shall be replaced. Oil filled transformers shall be stored in accordance with the manufacturer's requirements. Metal poles shall be handled and stored in accordance with the manufacturer's instructions.

#### 1.5 EXTRA MATERIALS

One additional spare fuse or fuse element for each furnished fuse or fuse element shall be delivered to the contracting officer when the electrical system is accepted. Two complete sets of all special tools required for maintenance shall be provided, complete with a suitable tool box. Special tools are those that only the manufacturer provides, for special purposes (to access compartments, or operate, adjust, or maintain special parts).

### PART 2 PRODUCTS

#### 2.1 STANDARD PRODUCT

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

#### 2.2 NAMEPLATES

### 2.2.1 General

Each major component of this specification shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a nameplate securely attached to the equipment. Nameplates shall be made of noncorrosive metal. Equipment containing liquid dielectrics shall have the type of dielectric on the nameplate. As a minimum, nameplates shall be provided for transformers and switchgear.

### 2.2.2 Liquid-Filled Transformer Nameplates

Power transformers shall be provided with nameplate information in accordance with IEEE C57.12.00. Nameplates shall indicate the number of gallons and composition of liquid-dielectric, and shall be permanently marked with a statement that the transformer dielectric to be supplied is non-polychlorinated biphenyl. If transformer nameplate is not so marked, the Contractor shall furnish manufacturer's certification for each transformer that the dielectric is non-PCB classified, with less than 50ppm PCB content in accordance with paragraph LIQUID DIELECTRICS. Certifications shall be related to serial numbers on transformer nameplates. Transformer dielectric exceeding the 50 ppm PCB content or transformers without certification will be considered as PCB insulated and will not be accepted.

## 2.3 CORROSION PROTECTION

### 2.3.1 Aluminum Materials

Aluminum shall not be used.

### 2.3.2 Ferrous Metal Materials

#### 2.3.2.1 Hardware

Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A 153/A 153M and ASTM A 123/A 123M.

#### 2.3.2.2 Equipment

Equipment and component items, including but not limited to transformer stations and ferrous metal luminaries not hot-dip galvanized or porcelain enamel finished, shall be provided with corrosion-resistant finishes which shall withstand 120 hours of exposure to the salt spray test specified in ASTM B 117 without loss of paint or release of adhesion of the paint primer coat to the metal surface in excess of 1/16 inch from the test mark. The scribed test mark and test evaluation shall be in accordance with ASTM D 1654 with a rating of not less than 7 in accordance with TABLE 1, (procedure A). Cut edges or otherwise damaged surfaces of hot-dip galvanized sheet steel or mill galvanized sheet steel shall be coated with a zinc rich paint conforming to the manufacturer's standard.

### 2.3.3 Finishing

Painting required for surfaces not otherwise specified and finish painting of items only primed at the factory shall be as specified in Section 09900 PAINTS AND COATINGS.

## 2.4 CABLES

Cables shall be single conductor type unless otherwise indicated.

#### 2.4.1 Medium-Voltage Cables

##### 2.4.1.1 General

Cable construction shall be Type MV, conforming to NFPA 70 and UL 1072. Cables shall be manufactured for use in duct applications.

##### 2.4.1.2 Ratings

Cables shall be rated for a circuit voltage of 15 kV.

##### 2.4.1.3 Conductor Material

Underground cables shall be soft drawn copper complying with ASTM B 3 and ASTM B 8 for regular concentric and compressed stranding or ASTM B 496 for compact stranding.

##### 2.4.1.4 Insulation

Cable insulation shall be ethylene-propylene-rubber (EPR) insulation conforming to the requirements of NEMA WC 8 and AEIC CS6. A 133 percent insulation level shall be used on 5 kV, 15 kV and 25 kV rated cables. The Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS.

##### 2.4.1.5 Shielding

Cables rated for 2 kV and above shall have a semiconducting conductor shield, a semiconducting insulation shield, and an overall copper tape shield for each phase. The shield tape shall be sized to meet IEEE C2 requirements for a ground fault availability .

##### 2.4.1.6 Neutrals

Neutral conductors shall be copper, employing the same insulation and jacket materials as phase conductors, except that a 600-volt insulation rating is acceptable.

##### 2.4.1.7 Jackets

Cables shall be provided with a PVC jacket.

#### 2.4.2 Low-Voltage Cables

Cables shall be rated 600 volts and shall conform to the requirements of NFPA 70, and must be UL listed for the application or meet the applicable section of either ICEA or NEMA standards.

##### 2.4.2.1 Conductor Material

Underground cables shall be annealed copper complying with ASTM B 3 and ASTM B 8. Intermixing of copper and aluminum conductors is not permitted.

##### 2.4.2.2 Insulation

Insulation must be in accordance with NFPA 70, and must be UL listed for

the application or meet the applicable sections of either ICEA, or NEMA standards.

#### 2.4.2.3 Jackets

Multiconductor cables shall have an overall PVC outer jacket.

#### 2.4.2.4 In Duct

Cables shall be single-conductor cable, in accordance with NFPA 70.

### 2.5 CABLE JOINTS, TERMINATIONS, AND CONNECTORS

#### 2.5.1 Medium-Voltage Cable Joints

Medium-voltage cable joints shall comply with IEEE Std 404 and IEEE Std 592.

Medium-voltage cable terminations shall comply with IEEE Std 48. Joints shall be the standard products of a manufacturer and shall be either of the factory preformed type or of the kit type containing tapes and other required parts. Joints shall have ratings not less than the ratings of the cables on which they are installed. Splice kits may be of the heat-shrinkable type for voltages up to 15 kV, of the premolded splice and connector type, the conventional taped type, or the resin pressure-filled overcast taped type for voltages up to 35 kV; except that for voltages of 7.5 kV or less a resin pressure-filled type utilizing a plastic-tape mold is acceptable. Joints used in manholes, handholes, vaults and pull boxes shall be certified by the manufacturer for waterproof, submersible applications.

#### 2.5.2 Medium-Voltage Separable Insulated Connectors

Separable insulated connectors shall comply with IEEE Std 386 and IEEE Std 592 and shall be of suitable construction or standard splice kits shall be used. Separable insulated connectors are acceptable for voltages up to 35 kV. Connectors shall be of the loadbreak type as indicated, of suitable construction for the application and the type of cable connected, and shall include cable shield adaptors. Separable insulated connectors shall not be used as substitutes for conventional permanent splices. External clamping points and test points shall be provided.

#### 2.5.3 Low-Voltage Cable Splices

Low-voltage cable splices and terminations shall be rated at not less than 600 Volts. Splices in conductors No. 10 AWG and smaller shall be made with an insulated, solderless, pressure type connector, conforming to the applicable requirements of UL 486A. Splices in conductors No. 8 AWG and larger shall be made with noninsulated, solderless, pressure type connector, conforming to the applicable requirements of UL 486A and UL 486B.

Splices shall then be covered with an insulation and jacket material equivalent to the conductor insulation and jacket. Splices below grade or in wet locations shall be sealed type conforming to ANSI C119.1 or shall be waterproofed by a sealant-filled, thick wall, heat shrinkable, thermosetting tubing or by pouring a thermosetting resin into a mold that surrounds the joined conductors.

#### 2.5.4 Terminations

Terminations shall be in accordance with IEEE Std 48, Class 1 or Class 2; of the molded elastomer, wet-process porcelain, prestretched elastomer,

heat-shrinkable elastomer, or taped type. Acceptable elastomers are track-resistant silicone rubber or track-resistant ethylene propylene compounds, such as ethylene propylene rubber or ethylene propylene diene monomer. Separable insulated connectors may be used for apparatus terminations, when such apparatus is provided with suitable bushings. Terminations shall be of the outdoor type, except that where installed inside outdoor equipment housings which are sealed against normal infiltration of moisture and outside air, indoor, Class 2 terminations are acceptable. Class 3 terminations are not acceptable. Terminations, where required, shall be provided with mounting brackets suitable for the intended installation and with grounding provisions for the cable shielding.

#### 2.5.4.1 Factory Preformed Type

Molded elastomer, wet-process porcelain, prestretched, and heat-shrinkable terminations shall utilize factory preformed components to the maximum extent practicable rather than tape build-up. Terminations shall have basic impulse levels as required for the system voltage level. Leakage distances shall comply with wet withstand voltage test requirements of IEEE Std 48 for the next higher Basic Insulation Level (BIL) level.

#### 2.5.4.2 Taped Terminations

Taped terminations shall use standard termination kits providing terminal connectors, field-fabricated stress cones, and rain hoods. Terminations shall be at least 12-1/2 inches long from the end of the tapered cable jacket to the start of the terminal connector, or not less than the kit manufacturer's recommendations, whichever is greater.

### 2.6 CONDUIT AND DUCTS

Duct lines shall be concrete-encased, thin-wall type for duct lines between manholes and for other medium-voltage lines. Low-voltage lines run elsewhere may be direct-burial, thick-wall type.

#### 2.6.1 Metallic Conduit

Intermediate metal conduit shall comply with UL 1242. Rigid galvanized steel conduit shall comply with UL 6 and ANSI C80.1. Metallic conduit fittings and outlets shall comply with UL 514A and NEMA FB 1.

#### 2.6.2 Nonmetallic Ducts

##### 2.6.2.1 Concrete Encased Ducts

UL 651 Schedule 40 or NEMA TC 6 Type EB.

##### 2.6.2.2 Direct Burial

UL 651 Schedule 80, or NEMA TC 6 Type DB.

#### 2.6.3 Conduit Sealing Compound

Compounds for sealing ducts and conduit shall have a putty-like consistency workable with the hands at temperatures as low as 35 degrees F, shall neither slump at a temperature of 300 degrees F, nor harden materially when exposed to the air. Compounds shall adhere to clean surfaces of fiber or plastic ducts; metallic conduits or conduit coatings; concrete, masonry, or lead; any cable sheaths, jackets, covers, or insulation materials; and the

common metals. Compounds shall form a seal without dissolving, noticeably changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect upon the hands of workmen or upon materials.

## 2.7 MANHOLES

Manholes shall be as indicated. Strength of manholes and their frames and covers shall conform to the requirements of IEEE C2. Precast-concrete manholes shall have the required strength established by ASTM C 478, ASTM C 478M. Frames and covers shall be made of gray cast iron and a machine-finished seat shall be provided to ensure a matching joint between frame and cover. Cast iron shall comply with ASTM A 48, Class 30B, minimum.

## 2.8 TRANSFORMERS AND SWITCHGEAR

Transformers and switchgear shall be of the outdoor type having the ratings and arrangements indicated. Medium-voltage ratings of cable terminations shall be 15 kV between phases for 133 percent insulation level.

### 2.8.1 Pad-Mounted Transformers

Pad-mounted transformers shall comply with ANSI C57.12.26 and shall be of the loop feed type with radial feed to the Fish Hatchery. Pad-mounted transformer stations shall be assembled and coordinated by one manufacturer and each transformer station shall be shipped as a complete unit so that field installation requirements are limited to mounting each unit on a concrete pad and connecting it to primary and secondary lines. Stainless steel pins and hinges shall be provided. Barriers shall be provided between high- and low-voltage compartments. High-voltage compartment doors shall be interlocked with low-voltage compartment doors to prevent access to any high-voltage section unless its associated low-voltage section door has first been opened. Compartments shall be sized to meet the specific dimensional requirements of ANSI C57.12.26. Pentahead locking bolts shall be provided with provisions for a padlock.

#### 2.8.1.1 High-Voltage Compartments

The high-voltage compartment shall be dead-front construction. Primary switching and protective devices shall include loadbreak switching, oil-immersed, current-limiting, bayonet-type fuses, medium-voltage separable loadbreak connectors, universal bushing wells and inserts or integral one piece bushings and surge arresters. Fuses shall comply with the requirements of paragraph PROTECTIVE DEVICES. The switch shall be mounted inside transformer tank with switch operating handle located in high-voltage compartment and equipped with metal loop for hook stick operation. Fuses shall be interlocked with switches so that fuses can be removed only when the associated switch is in the "OPEN" position. Adjacent to medium-voltage cable connections, a nameplate or equivalent stencilled inscription shall be provided inscribed "DO NOT OPEN CABLE CONNECTORS UNLESS SWITCH IS OPEN." Surge arresters shall be fully insulated and configured to terminate on a second set of high voltage bushings.

#### 2.8.1.2 Load-Break Switch

Loop feed sectionalizer switches: Provide three, two-position, oil-immersed type switches to permit closed transition loop feed and sectionalizing. Each switch shall be rated at 15 kV, 95 kV BIL, with a

continuous current rating and load-break rating of 200 amperes, and a make-and-latch rating of 10,000 rms amperes symmetrical. Locate the switch handle in the high-voltage compartment. Operation of switches shall be as follows:

#### 2.8.1.3 Transformer Tank Sections

Transformers shall comply with IEEE C57.12.00, ANSI C57.12.21, and ANSI C57.12.26 and shall be of the mineral oil-insulated type. Transformers shall be suitable for outdoor use and shall have 2 separate windings per phase. Standard NEMA primary taps shall be provided. Where primary taps are not specified, 4, 2-1/2 percent rated kVA high-voltage taps shall be provided 2 above and 2 below rated, primary voltage. Operating handles for primary tap changers for de-energized operation shall be located within high-voltage compartments, externally to transformer tanks. Adjacent to the tap changer operating handle, a nameplate or equivalent stenciled inscription shall be provided and inscribed "DO NOT OPERATE UNDER LOAD." Transformer ratings at 60 Hz shall be as follows:

Three-phase capacity.....500 kVA.  
 Impedance.....4.0%(Min.).  
 Temperature Rise.....65 degrees C.  
 High-voltage winding.....12470 volts.  
 High-voltage winding connections.....Delta.  
 Low-voltage winding.....480Y/277 volts.  
 Low-voltage winding connections.....Grounded Wye

#### 2.8.1.4 Low-Voltage Cable Compartments

Neutrals shall be provided with fully-insulated bushings. Clamp type cable terminations, suitable for copper conductors entering from below, shall be provided as necessary.

#### 2.8.1.5 Accessories

High-voltage warning signs shall be permanently attached to each side of transformer stations. Voltage warning signs shall comply with IEEE C2. Copper-faced steel or stainless steel ground connection pads shall be provided in both the high- and low-voltage compartments. Dial-type thermometer, liquid-level gauge, and drain valve with built-in sampling device shall be provided for each transformer station. Insulated-bushing-type parking stands shall be provided adjacent to each separable load-break elbow to provide for cable isolation during sectionalizing operations.

### 2.9 PROTECTIVE DEVICES

#### 2.9.1 Fuses, Low-Voltage, Including Current-Limiting

Low-voltage fuses shall conform to NEMA FU 1. Time delay and nontime delay options shall be as specified. Equipment provided under this contract shall be provided with a complete set of properly rated fuses when the equipment manufacturer utilizes fuses in the manufacture of the equipment,

or if current-limiting fuses are required to be installed to limit the ampere-interrupting capacity of circuit breakers or equipment to less than the maximum available fault current at the location of the equipment to be installed. Fuses shall have a voltage rating of not less than the phase-to-phase circuit voltage, and shall have the time-current characteristics required for effective power system coordination.

#### 2.9.1.1 Cartridge Fuses

Cartridge fuses, current-limiting type, Class RK1 or RK5 shall have tested interrupting capacity not less than 200,000 amperes. Fuse holders shall be the type that will reject Class H fuses.

- a. Class R fuses shall conform to UL 198E.

#### 2.9.1.2 Transformer Circuit Fuses

Transformer circuit fuses shall be Class RK1 or RK5, current-limiting, time-delay with 200,000 amperes interrupting capacity.

### 2.10 SURGE ARRESTERS

Surge arresters shall comply with NEMA LA 1, IEEE C62.1, IEEE C62.2, and IEEE C62.11 and shall be provided where indicated. Arresters shall be distribution class, rated as shown. Arresters for use at elevations in excess of 6000 feet above mean sea level shall be specifically rated for that purpose. Arresters shall be equipped with mounting brackets suitable for the indicated installations. Arresters shall be of the metal-oxide varistor type.

### 2.11 GROUNDING AND BONDING

#### 2.11.1 Driven Ground Rods

Ground rods shall be copper-clad steel conforming to UL 467 not less than 3/4 inch in diameter by 10 feet in length. Sectional type rods may be used.

#### 2.11.2 Grounding Conductors

Grounding conductors shall be bare, except where installed in conduit with associated phase conductors. Insulated conductors shall be of the same material as phase conductors and green color-coded, except that conductors shall be rated no more than 600 volts. Bare conductors shall be ASTM B 8 soft-drawn unless otherwise indicated. Aluminum is not acceptable.

### 2.12 CONCRETE AND REINFORCEMENT

Concrete work shall have minimum 3000 psi compressive strength and conform to the requirements of Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Concrete reinforcing shall be as specified in Section 03200A CONCRETE REINFORCEMENT.

### 2.13 PADLOCKS

Padlocks shall comply with Section 08710 DOOR HARDWARE.

### 2.14 CABLE FIREPROOFING SYSTEMS

Cable fireproofing systems shall be listed in FM P7825a as a fire-protective coating or tape approved for grouped electrical conductors and shall be suitable for application on the type of medium-voltage cables provided. After being fully cured, materials shall be suitable for use where exposed to oil, water, gases, salt water, sewage, and fungus and shall not damage cable jackets or insulation. Asbestos materials are not acceptable.

#### 2.14.1 Fireproof Coating

Cable fireproofing coatings shall be compounded of water-based thermoplastic resins, flame-retardant chemicals, and inorganic noncombustible fibers and shall be suitable for the application methods used. Coatings applied on bundled cables shall have a derating factor of less than 5 percent, and a dielectric strength of 95 volts per mil minimum after curing.

#### 2.14.2 Fireproofing Tape

Fireproofing tape shall be at least 2 inches wide and shall be a flexible, conformable, polymeric, elastomer tape designed specifically for fireproofing cables.

#### 2.14.3 Plastic Tape

Preapplication plastic tape shall be pressure sensitive, 10 mil thick, conforming to UL 510.

### 2.15 LIQUID DIELECTRICS

Liquid dielectrics for transformers, capacitors, reclosers, and other liquid-filled electrical equipment shall be non-polychlorinated biphenyl (PCB) mineral-oil or less-flammable liquid as specified. Nonflammable fluids shall not be used. Tetrachloroethylene (perchloroethylene) and 1, 2, 4 trichlorobenzene fluids shall not be used. Liquid dielectrics in retrofitted equipment shall be certified by the manufacturer as having less than 50 parts per million (ppm) PCB content. In lieu of the manufacturer's certification, the Contractor may submit a test sample of the dielectric in accordance with ASTM D 923 and have tests performed per ASTM D 4059 at a testing facility approved by the Contracting Officer. Equipment with test results indicating PCB level exceeding 50 ppm shall be replaced.

### 2.16 COORDINATED POWER SYSTEM PROTECTION

Analyses shall be prepared to demonstrate that the equipment selected and system constructed meet the contract requirements for equipment ratings, coordination, and protection. They shall include a load flow analysis, a fault current analysis, and a protective device coordination study. The studies shall be performed by a registered professional engineer with demonstrated experience in power system coordination in the last three years. The Contractor shall provide a list of references complete with points of contact, addresses and telephone numbers. The selection of the engineer is subject to the approval of the Contracting Officer.

#### 2.16.1 Scope of Analyses

The fault current analysis, and protective device coordination study shall begin at: the nearest upstream device in the existing source system and extend through the downstream devices at the load end.

### 2.16.2 Determination of Facts

The time-current characteristics, features, and nameplate data for each existing protective device shall be determined and documented. The Contractor shall coordinate with the Valley Electric Co., Mr. Larry Tade, Phone # (800) 877-2157 or (406) 228-9351 for fault current availability at the site. The Contractor shall utilize the fault current availability indicated as a basis for fault current studies.

### 2.16.3 Single Line Diagram

A single line diagram shall be prepared to show the electrical system buses, devices, transformation points, and all sources of fault current (including generator and motor contributions). A fault-impedance diagram or a computer analysis diagram may be provided. Each bus, device or transformation point shall have a unique identifier. If a fault-impedance diagram is provided, impedance data shall be shown. Locations of switches, breakers, and circuit interrupting devices shall be shown on the diagram together with available fault data, and the device interrupting rating.

### 2.16.4 Fault Current Analysis

#### 2.16.4.1 Method

The fault current analysis shall be performed in accordance with methods described in IEEE Std 242, and IEEE Std 399.

#### 2.16.4.2 Data

Actual data shall be utilized in fault calculations. Bus characteristics and transformer impedances shall be those proposed. Data shall be documented in the report.

### 2.16.5 Coordination Study

The study shall demonstrate that the maximum possible degree of selectivity has been obtained between devices specified, consistent with protection of equipment and conductors from damage from overloads and fault conditions. The study shall include a description of the coordination of the protective devices in this project. Provide a written narrative that describes: which devices may operate in the event of a fault at each bus; the logic used to arrive at device ratings and settings; situations where system coordination is not achievable due to device limitations (an analysis of any device curves which overlap); coordination between upstream and downstream devices; and any relay settings. Recommendations to improve or enhance system reliability, and detail where such changes would involve additions or modifications to the contract and cost changes (addition or reduction) shall be provided. Composite coordination plots shall be provided on log-log graph paper. The study shall be coordinated with Coordination Study required in Specification Section 16415, ELECTRICAL WORK, INTERIOR.

### 2.16.6 Study Report

- a. The report shall include a narrative describing: the analyses performed; the bases and methods used; and the desired method of coordinated protection of the power system.
- b. The study shall include descriptive and technical data for

existing devices and new protective devices proposed. The data shall include manufacturers published data, nameplate data, and definition of the fixed or adjustable features of the existing or new protective devices.

- c. The report shall document utility company data including system voltages, fault MVA, system X/R ratio, time-current characteristics curves, current transformer ratios, and relay device numbers and settings; and existing power system data including time-current characteristic curves and protective device ratings and settings.
- d. The report shall contain fully coordinated composite time-current characteristic curves for each bus in the system, as required to ensure coordinated power system protection between protective devices or equipment. The report shall include recommended ratings and settings of all protective devices in tabulated form.
- e. The report shall provide the calculation performed for the analyses, including computer analysis programs utilized. The name of the software package, developer, and version number shall be provided.

### PART 3 EXECUTION

#### 3.1 GENERAL INSTALLATION REQUIREMENTS

Equipment and devices shall be installed and energized in accordance with the manufacturer's published instructions. Steel conduits installed underground shall be installed and protected from corrosion in conformance with the requirements of Section 16415A ELECTRICAL WORK, INTERIOR. Except as covered herein, excavation, trenching, and backfilling shall conform to the requirements of Section 02316A EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Concrete work shall have minimum 3000 psi compressive strength and conform to the requirements of Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

##### 3.1.1 Conformance to Codes

The installation shall comply with the requirements and recommendations of NFPA 70 and IEEE C2 as applicable.

##### 3.1.2 Verification of Dimensions

The Contractor shall become familiar with details of the work, shall verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

##### 3.1.3 Disposal of Liquid Dielectrics

PCB-contaminated dielectrics must be marked as PCB and transported to and incinerated by an approved EPA waste disposal facility. The Contractor shall furnish certification of proper disposal. Contaminated dielectrics shall not be diluted to lower the contamination level.

#### 3.2 CABLE INSTALLATION

The Contractor shall obtain from the manufacturer an installation manual or set of instructions which addresses such aspects as cable construction,

insulation type, cable diameter, bending radius, cable temperature, lubricants, coefficient of friction, conduit cleaning, storage procedures, moisture seals, testing for and purging moisture, etc. The Contractor shall then prepare a checklist of significant requirements, perform pulling calculations and prepare a pulling plan which shall be submitted along with the manufacturers instructions in accordance with SUBMITTALS.

### 3.2.1 Cable Installation Plan and Procedure

Cable shall be installed strictly in accordance with the cable manufacturer's recommendations. Each circuit shall be identified by means of a fiber, laminated plastic, or non-ferrous metal tags, or approved equal, in each manhole and each terminal. Each tag shall contain the following information; cable type, conductor size, circuit number, circuit voltage, cable destination and phase identification.

#### 3.2.1.1 Cable Inspection

The cable reel shall be inspected for correct storage positions, signs of physical damage, and broken end seals. If end seal is broken, moisture shall be removed from cable in accordance with the cable manufacturer's recommendations.

#### 3.2.1.2 Duct Cleaning

Duct shall be cleaned with an assembly that consists of a flexible mandrel (manufacturers standard product in lengths recommended for the specific size and type of duct) that is 1/4 inch less than inside diameter of duct, 2 wire brushes, and a rag. The cleaning assembly shall be pulled through conduit a minimum of 2 times or until less than a volume of 8 cubic inches of debris is expelled from the duct.

#### 3.2.1.3 Duct Lubrication

The cable lubricant shall be compatible with the cable jacket for cable that is being installed. Application of lubricant shall be in accordance with lubricant manufacturer's recommendations.

#### 3.2.1.4 Cable Installation

The Contractor shall provide a cable feeding truck and a cable pulling winch as required. The Contractor shall provide a pulling grip or pulling eye in accordance with cable manufacturer's recommendations. The pulling grip or pulling eye apparatus shall be attached to polypropylene or manilla rope followed by lubricant front end packs and then by power cables. A dynamometer shall be used to monitor pulling tension. Pulling tension shall not exceed cable manufacturer's recommendations. The Contractor shall not allow cables to cross over while cables are being fed into duct. For cable installation in cold weather, cables shall be kept at 50 degrees F temperature for at least 24 hours before installation.

#### 3.2.1.5 Cable Installation Plan

The Contractor shall submit a cable installation plan for all cable pulls in accordance with the detail drawings portion of paragraph SUBMITTALS. Cable installation plan shall include:

- a. Site layout drawing with cable pulls identified in numeric order of expected pulling sequence and direction of cable pull.

- b. List of cable installation equipment.
- c. Lubricant manufacturer's application instructions.
- d. Procedure for resealing cable ends to prevent moisture from entering cable.
- e. Cable pulling tension calculations of all cable pulls.
- f. Cable percentage conduit fill.
- g. Cable sidewall thrust pressure.
- h. Cable minimum bend radius and minimum diameter of pulling wheels used.
- i. Cable jam ratio.
- j. Maximum allowable pulling tension on each different type and size of conductor.
- k. Maximum allowable pulling tension on pulling device.

### 3.2.2 Duct Line

Medium-voltage cables and Low-voltage cables shall be installed in duct lines where indicated. Cable splices in low-voltage cables shall be made in manholes only, except as otherwise noted. Cable joints in medium-voltage cables shall be made in manholes only. Neutral and grounding conductors shall be installed in the same duct with their associated phase conductors.

### 3.2.3 Electric Manholes

Cables shall be routed around the interior walls and securely supported from walls on cables racks. Cable routing shall minimize cable crossover, provide access space for maintenance and installation of additional cables, and maintain cable separation in accordance with IEEE C2.

### 3.3 CABLE JOINTS

Medium-voltage cable joints shall be made by qualified cable splicers only. Qualifications of cable splicers shall be submitted in accordance with paragraph SUBMITTALS. Shields shall be applied as required to continue the shielding system through each entire cable joint. Shields may be integrally molded parts of preformed joints. Shields shall be grounded at each joint or in accordance with manufacturer's recommended practice. Cable joints shall provide insulation and jacket equivalent to that of the associated cable.

### 3.4 FIREPROOFING

Each medium-voltage cable and conductor in manholes shall be fire-proofed for their entire length within the manhole. Where cables and conductors have been lubricated to enhance pulling into ducts, the lubricant shall be removed from cables and conductors exposed in the manhole before fireproofing.

### 3.4.1 Tape Method

Before application of fireproofing tape, plastic tape wrapping shall be applied over exposed metallic items such as the cable ground wire, metallic outer covering, or armor to minimize the possibility of corrosion from the fireproofing materials and moisture. Before applying fireproofing tape, irregularities of cables, such as at cable joints, shall be evened out with insulation putty. A flexible conformable polymeric elastomer fireproof tape shall be wrapped tightly around each cable spirally in 1/2 lapped wrapping or in 2 butt-jointed wrappings with the second wrapping covering the joints of the first.

### 3.4.2 Sprayable Method

Manholes shall be power ventilated until coatings are dry and dewatered and the coatings are cured. Ventilation requirements shall be in accordance with the manufacturer's instruction, but not less than 10 air changes per hour shall be provided. Cable coatings shall be applied by spray, brush, or glove to a wet film thickness that reduces to the dry film thickness approved for fireproofing by FM P7825a. Application methods and necessary safety precautions shall be in accordance with the manufacturers instructions. After application, cable coatings shall be dry to the touch in 1 to 2 hours and fully cured in 48 hours, except where the manufacturer has stated that because of unusual humidity or temperature, longer periods may be necessary.

## 3.5 DUCT LINES

### 3.5.1 Requirements

Numbers and sizes of ducts shall be as indicated. Duct lines shall be laid with a minimum slope of 4 inches per 100 feet. Depending on the contour of the finished grade, the high-point may be at a terminal and a manhole. Short-radius manufactured 90-degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable. The minimum manufactured bend radius shall be 18 inches for ducts of less than 3 inch diameter, and 36 inches for ducts 3 inches or greater in diameter. Otherwise, long sweep bends having a minimum radius of 25 feet shall be used for a change of direction of more than 5 degrees, either horizontally or vertically. Both curved and straight sections may be used to form long sweep bends, but the maximum curve used shall be 30 degrees and manufactured bends shall be used. Ducts shall be provided with end bells whenever duct lines terminate in manholes .

### 3.5.2 Treatment

Ducts shall be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and match factory tapers. A coupling recommended by the duct manufacturer shall be used whenever an existing duct is connected to a duct of different material or shape. Ducts shall be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.

### 3.5.3 Concrete Encasement

Ducts requiring concrete encasements shall comply with NFPA 70, except that

electrical duct bank configurations for ducts 6 inches in diameter shall be determined by calculation and as shown on the drawings. The separation between adjacent electric power and communication ducts shall conform to IEEE C2. Duct line encasements shall be monolithic construction. Where a connection is made to a previously poured encasement, the new encasement shall be well bonded or doweled to the existing encasement. The Contractor shall submit proposed bonding method for approval in accordance with the detail drawing portion of paragraph SUBMITTALS. At any point tops of concrete encasements shall be not less than the cover requirements listed in NFPA 70. Separators or spacing blocks shall be made of steel, concrete, plastic, or a combination of these materials placed not farther apart than 4 feet on centers. Ducts shall be securely anchored to prevent movement during the placement of concrete and joints shall be staggered at least 6 inches vertically.

#### 3.5.4 Nonencased Direct-Burial

Top of duct lines shall be not less than 24 inches below finished grade and shall be installed with a minimum of 3 inches of earth around each duct, except that between adjacent electric power and communication ducts, 12 inches of earth is required. Bottoms of trenches shall be graded toward manholes and shall be smooth and free of stones, soft spots, and sharp objects. Where bottoms of trenches comprise materials other than sand, a 3 inch layer of sand shall be laid first and compacted to approximate densities of surrounding firm soil before installing ducts. Joints in adjacent tiers of duct shall be vertically staggered at least 6 inches. The first 6 inch layer of backfill cover shall be sand compacted as previously specified. The rest of the excavation shall be backfilled and compacted in 3 to 6 inch layers. Duct banks may be held in alignment with earth. However, high-tiered banks shall use a wooden frame or equivalent form to hold ducts in alignment prior to backfilling.

#### 3.5.5 Installation of Couplings

Joints in each type of duct shall be made up in accordance with the manufacturer's recommendations for the particular type of duct and coupling selected and as approved.

##### 3.5.5.1 Plastic Duct

Duct joints shall be made by brushing a plastic solvent cement on insides of plastic coupling fittings and on outsides of duct ends. Each duct and fitting shall then be slipped together with a quick 1/4-turn twist to set the joint tightly.

#### 3.5.6 Duct Line Markers

Duct line markers shall be provided at the ends of long duct line stubouts or for other ducts whose locations are indeterminate because of duct curvature or terminations at completely below-grade structures. In addition to markers, a 5 mil brightly colored plastic tape, not less than 3 inches in width and suitably inscribed at not more than 10 feet on centers with a continuous metallic backing and a corrosion-resistant 1 mil metallic foil core to permit easy location of the duct line, shall be placed approximately 12 inches below finished grade levels of such lines.

### 3.6 MANHOLES

#### 3.6.1 General

Manholes shall be constructed approximately where shown. The exact location of each manhole shall be determined after careful consideration has been given to the location of other utilities, grading, and paving. The location of each manhole shall be approved by the Contracting Officer before construction of the manhole is started. Manholes shall be the type noted on the drawings and shall be constructed in accordance with the applicable details as indicated. Top, walls, and bottom shall consist of reinforced concrete. Walls and bottom shall be of monolithic concrete construction. The Contractor may at his option utilize monolithically constructed precast-concrete manholes having the required strength and inside dimensions as required by the drawings or specifications. In paved areas, frames and covers for manhole entrances in vehicular traffic areas shall be flush with the finished surface of the paving. In unpaved areas, the top of manhole covers shall be approximately 1/2 inch above the finished grade. Where existing grades that are higher than finished grades are encountered, concrete assemblies designed for the purpose shall be installed to elevate temporarily the manhole cover to existing grade level.

All duct lines entering manholes must be installed on compact soil or otherwise supported when entering a manhole to prevent shear stress on the duct at the point of entrance to the manhole. Duct lines entering cast-in-place concrete manholes shall be cast in-place with the manhole. Duct lines entering precast concrete manholes through a precast knockout penetration shall be grouted tight with a portland cement mortar. PVC duct lines entering precast manholes through a PVC endbell shall be solvent welded to the endbell. A cast metal grille-type sump frame and cover shall be installed over the manhole sump. A cable-pulling iron shall be installed in the wall opposite each duct line entrance.

### 3.6.2 Electric Manholes (MH#3A TYPE "G" & MH#3B TYPE "D")

Cables shall be securely supported from walls by hot-dip galvanized cable racks with a plastic coating over the galvanizing and equipped with adjustable hooks and insulators. The number of cable racks indicated shall be installed in each manhole and not less than 2 spare hooks shall be installed on each cable rack. Insulators shall be made of high-glazed porcelain. Insulators will not be required on spare hooks.

### 3.6.3 Ground Rods

A ground rod shall be installed at the manholes. Ground rods shall be driven into the earth before the manhole floor is poured so that approximately 4 inches of the ground rod will extend above the manhole floor. When precast concrete manholes are used, the top of the ground rod may be below the manhole floor and a No. 1/0 AWG ground conductor brought into the manhole through a watertight sleeve in the manhole wall.

## 3.7 PAD-MOUNTED EQUIPMENT INSTALLATION

Pad-mounted equipment, shall be installed on concrete pads in accordance with the manufacturer's published, standard installation drawings and procedures, except that they shall be modified to meet the requirements of this document. Units shall be installed so that they do not damage equipment or scratch painted or coated surfaces. After installation, surfaces shall be inspected and scratches touched up with a paint or coating provided by the manufacturer especially for this purpose. Three-phase transformers shall be installed with A-B-C phase sequence.

### 3.7.1 Concrete Pads

### 3.7.1.1 Construction

Concrete pads for pad-mounted electrical equipment may be either pre-fabricated or shall be poured-in-place. Pads shall be constructed as indicated, except that exact pad dimensions and mounting details are equipment specific and are the responsibility of the Contractor. Tops of concrete pads shall be level and shall project 4 inches above finished paving or grade and sloped to drain. Edges of concrete pads shall have 3/4 inch chamfer. Conduits for primary, secondary, and grounding conductors shall be set in place prior to placement of concrete pads. Where grounding electrode conductors are installed through concrete pads, PVC conduit sleeves shall be installed through the concrete to provide physical protection. To facilitate cable installation and termination, the concrete pad shall be provided with a rectangular hole below the primary and secondary compartments, sized in accordance with the manufacturer's recommended dimensions. Upon completion of equipment installation the rectangular hole shall be filled with masonry grout.

### 3.7.1.2 Concrete and Reinforcement

Concrete work shall have minimum 3000 psi compressive strength and conform to the requirements of Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Concrete pad reinforcement shall be in accordance with Section 03200A CONCRETE REINFORCEMENT.

### 3.7.1.3 Sealing

When the installation is complete, the Contractor shall seal all conduit and other entries into the equipment enclosure with an approved sealing compound. Seals shall be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

### 3.7.2 Padlocks

Padlocks shall be provided for pad-mounted equipment and for each fence gate. Padlocks shall be keyed alike and similar to padlocks on existing electrical sectionalizer.

## 3.8 CONNECTIONS TO BUILDINGS

Cables shall be extended into the various buildings as indicated, and shall be connected to the first applicable termination point in each building. Interfacing with building interior conduit systems shall be at conduit stubouts terminating 5 feet outside of a building and 2 feet below finished grade as specified and provided under Section 16415A ELECTRICAL WORK, INTERIOR. After installation of cables, conduits shall be sealed with caulking compound to prevent entrance of moisture or gases into buildings.

## 3.9 GROUNDING

A ground ring consisting of the indicated configuration of bare copper conductors and driven ground rods shall be installed around pad-mounted equipment. Equipment frames of metal-enclosed equipment, and other noncurrent-carrying metal parts, such as cable shields, cable sheaths, and metallic conduit shall be grounded.

### 3.9.1 Grounding Electrodes

Grounding electrodes shall be installed as shown on the drawings and as follows:

- a. Driven rod electrodes - Unless otherwise indicated, ground rods shall be driven into the earth until the tops of the rods are approximately 1 foot below finished grade.
- b. Ground ring - A ground ring shall be installed as shown consisting of bare copper conductors installed 24 inches, plus or minus 3 inches, below finished top of soil grade. Ground ring conductors shall be No. 2 AWG, minimum.
- d. Additional electrodes - When the required ground resistance is not met, additional electrodes shall be provided to achieve the specified ground resistance. The additional electrodes will be up to three, 10 foot rods spaced a minimum of 10 feet apart. In high ground resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately.

#### 3.9.2 Grounding and Bonding Connections

Connections above grade shall be made by the fusion-welding process or with bolted solderless connectors, in compliance with UL 467, and those below grade shall be made by a fusion-welding process. Where grounding conductors are connected to aluminum-composition conductors, specially treated or lined copper-to-aluminum connectors suitable for this purpose shall be used.

#### 3.9.3 Grounding and Bonding Conductors

Grounding and bonding conductors include conductors used to bond transformer enclosures and equipment frames to the grounding electrode system. Grounding and bonding conductors shall be sized as shown, and located to provide maximum physical protection. Bends greater than 45 degrees in ground conductors are not permitted. Routing of ground conductors through concrete shall be avoided. When concrete penetration is necessary, nonmetallic conduit shall be cast flush with the points of concrete entrance and exit so as to provide an opening for the ground conductor, and the opening shall be sealed with a suitable compound after installation.

#### 3.9.4 Surge Arrester Grounding

Surge arresters and neutrals shall be bonded directly to the transformer enclosure and then to the grounding electrode system with a bare copper conductor, sized as shown. Lead lengths shall be kept as short as practicable with no kinks or sharp bends.

#### 3.9.5 Manhole

Ground rods installed in manholes shall be connected to cable racks, cable-pulling irons, the cable shielding, metallic sheath at each cable joint or splice by means of a No. 4 AWG braided tinned copper wire. Connections to metallic cable sheaths shall be by means of tinned terminals soldered to ground wires and to cable sheaths. Care shall be taken in soldering not to damage metallic cable sheaths or shields. Ground rods

shall be protected with a double wrapping of pressure-sensitive plastic tape for a distance of 2 inches above and 6 inches below concrete penetrations. Grounding electrode conductors shall be neatly and firmly attached to manhole walls and the amount of exposed bare wire shall be held to a minimum.

### 3.10 FIELD TESTING

#### 3.10.1 General

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 30 days prior to conducting tests. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform all tests and inspections recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. Field test reports shall be signed and dated by the Contractor.

#### 3.10.2 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

#### 3.10.3 Ground-Resistance Tests

The resistance of each grounding electrode, each grounding electrode system and the ground ring shall be measured using the fall-of-potential method defined in IEEE Std 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

- a. Single rod electrode - 25 ohms.
- b. Multiple rod electrodes - 25 ohms.
- c. Ground ring - 25 ohms.

#### 3.10.4 Medium-Voltage Cable Test

After installation and before the operating test or connection to an existing system, the medium-voltage cable system shall be given a high potential test. Direct-current voltage shall be applied on each phase conductor of the system by connecting conductors as one terminal and connecting grounds or metallic shieldings or sheaths of the cable as the other terminal for each test. Prior to making the test, the cables shall be isolated by opening applicable protective devices and disconnecting equipment. The test shall be conducted with all splices, connectors, and terminations in place. The method, voltage, length of time, and other characteristics of the test for initial installation shall be in accordance with NEMA WC 7 or NEMA WC 8 for the particular type of cable installed,

except that 28 kV and 35 kV insulation test voltages shall be in accordance with either AEIC CS5 or AEIC CS6 as applicable, and shall not exceed the recommendations of IEEE Std 404 for cable joints and IEEE Std 48 for cable terminations unless the cable and accessory manufacturers indicate higher voltages are acceptable for testing. Should any cable fail due to a weakness of conductor insulation or due to defects or injuries incidental to the installation or because of improper installation of cable, cable joints, terminations, or other connections, the Contractor shall make necessary repairs or replace cables as directed. Repaired or replaced cables shall be retested.

#### 3.10.5 Low-Voltage Cable Test

Low-voltage cable, complete with splices, shall be tested for insulation resistance after the cables are installed, in their final configuration, ready for connection to the equipment, and prior to energization. The test voltage shall be 500 volts dc, applied for one minute between each conductor and ground and between all possible combinations conductors in the same trench, duct, or cable, with all other conductors in the same trench, duct, or conduit. The minimum value of insulation shall be:

$$R \text{ in megohms} = (\text{rated voltage in kV} + 1) \times 1000 / (\text{length of cable in feet})$$

Each cable failing this test shall be repaired or replaced. The repaired cable shall be retested until failures have been eliminated.

#### 3.10.6 Operating Tests

After the installation is completed, and at such times as the Contracting Officer may direct, the Contractor shall conduct operating tests for approval. The equipment shall be demonstrated to operate in accordance with the requirements herein. An operating test report shall be submitted in accordance with paragraph SUBMITTALS.

#### 3.11 ACCEPTANCE

Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected.

-- End of Section --

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## SECTION 16415A

ELECTRICAL WORK, INTERIOR  
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## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.1	(1995) Code for Electricity Metering
ANSI C12.10	(1997) Electromechanical Watthour Meters
ANSI C12.11	(1987; R 1993) Instrument Transformers for Revenue Metering, 10 kV BIL through 350 kV BIL (0.6 kV NSV through 69 kV NSV)
ANSI C12.4	(1984; R 1996) Mechanical Demand Registers
ANSI C135.30	(1988) Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction
ANSI C37.16	(2000) Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors - Preferred Ratings, Related Requirements, and Application Recommendations
ANSI C39.1	(1981; R 1992) Requirements for Electrical Analog Indicating Instruments
ANSI C57.12.10	(1988) Safety Requirements for Transformers 230 kV and Below 833/958 Through 8333/10417 kVA, Single-Phase, and 750/862 Through 60 000/80 000/ 100 000 kVA, Three-Phase Without Load Tap Charging; and 3750/4687 Through 60 000/80 000/100/000 kVA With Load Tap Charging
ANSI C57.12.13	(1982) Conformance Requirements for Liquid-Filled Transformers Used in Unit Installations, Including Unit Substations
ANSI C57.12.27	(1982) Conformance Requirements for Liquid-Filled Distribution Transformers Used in Pad-Mounted Installations, Including Unit Substations
ANSI C57.12.50	(1981; R 1989) Ventilated Dry-Type Distribution Transformers 1 to 500 kVA, Single-Phase; and 15 to 500 kVA,

	Three-Phase with High-Voltage 601 to 34 500 Volts, Low-Voltage 120 to 600 Volts
ANSI C57.12.51	(1981; R 1989) Ventilated Dry-Type Power Transformers, 501 kVA and Larger, Three-Phase, with High-Voltage 601 to 34 500 Volts, Low-Voltage 208Y/120 to 4160 Volts
ANSI C57.12.52	(1981; R 1989) Sealed Dry-Type Power Transformers, 501 kVA and Larger, Three-Phase with High-Voltage 601 to 34 500 Volts, Low-Voltage 208Y/120 to 4160 Volts
ANSI C57.12.70	(1978; R 1993) Terminal Markings and Connections for Distribution and Power Transformers
ANSI C78.1	(1991; C78.1a; R 1996) Fluorescent Lamps - Rapid-Start Types - Dimensional and Electrical Characteristics
ANSI C78.1350	(1990) Electric Lamps - 400-Watt, 100-Volt, S51 Single-Ended High-Pressure Sodium Lamps
ANSI C78.1351	(1989) Electric Lamps - 250-Watt, 100-Volt S50 Single-Ended High-Pressure Sodium Lamps
ANSI C78.1352	(1990) Electric Lamps - 1000-Watt, 250-Volt, S52 Single-Ended High-Pressure Sodium Lamps
ANSI C78.1355	(1989) Electric Lamps - 150-Watt, 55-Volt S55 High-Pressure Sodium Lamps
ANSI C78.1375	(1996) 400-Watt, M59 Single-Ended Metal-Halide Lamps
ANSI C78.1376	(1996) 1000-Watt, M47 Metal-Halide Lamps
ANSI C78.20	(1995) Electric Lamps - Characteristics of Incandescent Lamps A, G, PS, and Similar Shapes with E26 Medium Screw Bases
ANSI C78.21	(1995) Physical and Electrical Characteristics - Incandescent Lamps - PAR and R Shapes
ANSI C78.2A	(1991) 18 & 26- Watt, Compact Fluorescent Quad Tube Lamps **
ANSI C78.2B	(1992) 9 & 13-Watt, Compact Fluorescent Quad Tube Lamps **
ANSI C80.5	(1995) Rigid Aluminum Conduit
ANSI C82.1	(1997) Specifications for Fluorescent Lamp

## Ballasts \ \$18.00\$ \ F \ X Addenda D &amp; E

ANSI C82.4	(1992) Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)
AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)	
ASTM B 1	(1995) Hard-Drawn Copper Wire
ASTM B 8	(1999) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM D 4059	(1996) Analysis of Polychlorinated Biphenyls in Insulating Liquids by Gas Chromatography
ASTM D 709	(2000) Laminated Thermosetting Materials
INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)	
IEEE C2	(1997) National Electrical Safety Code
IEEE C37.13	(1990; R 1995) Low-Voltage AC Power Circuit Breakers Used in Enclosures
IEEE C37.20.1	(1993) Metal-Enclosed Low-Voltage Power Circuit-Breaker Switchgear
IEEE C57.100	(1999) Test Procedure for Thermal Evaluation of Oil-Immersed Distribution Transformers \ \$avail only as part of Distribution, Power, and Regulating Transformers Stds Collection
IEEE C57.12.00	(1993) Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
IEEE C57.12.80	(1996) Terminology for Power and Distribution Transformers \ \$avail only as part of Distribution, Power, and Regulating Transformer Stds Collection
IEEE C57.12.90	1999) Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers and Guide for Short-Circuit Testing of Distribution and Power Transformers \ \$avail only as part of Distribution, Power, and Regulating Transformers Stds Collection
IEEE C57.13	(1993) Instrument Transformers
IEEE C57.98	(1993) Guide for Transformer Impulse Tests \ \$avail only as part of Distribution, Power, and Regulating Transformers Stds Collection

IEEE C62.41 (1991; R 1995) Surge Voltages in Low-Voltage AC Power Circuits

IEEE Std 242 (1986; R 1991) Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems

IEEE Std 399 (1997) Recommended Practice for Industrial and Commercial Power Systems Analysis

IEEE Std 81 (1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1) \\\\$31.00\$\\F

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (1997) Enclosures for Electrical Equipment (1000 Volts Maximum)

NEMA AB 1 (1993) Molded Case Circuit Breakers and Molded Case Switches

NEMA BU 1 (1994) Busways

NEMA FU 1 (1986) Low Voltage Cartridge Fuses

NEMA ICS 1 (1993) Industrial Control and Systems

NEMA ICS 2 (1993) Industrial Controls and Systems Controllers, Contactors, and Overload Relays Rated Not More Than 2,000 Volts AC or 750 Volts DC

NEMA ICS 3 (1993) Industrial Control and Systems Factory Built Assemblies

NEMA ICS 6 (1993) Industrial Control and Systems, Enclosures

NEMA LE 4 (1987) Recessed Luminaires, Ceiling Compatibility

NEMA MG 1 (1998) Motors and Generators

NEMA MG 10 (1994) Energy Management Guide for Selection and Use of Polyphase Motors

NEMA OS 1 (1996) Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports

NEMA OS 2 (1998) Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports

NEMA PB 1 (1995) Panelboards

NEMA PB 2 (1995) Deadfront Distribution Switchboards

NEMA PE 5 (1996) Utility Type Battery Chargers

NEMA RN 1	(1998) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA SG 3	(1995) Power Switching Equipment
NEMA ST 20	(1992) Dry-Type Transformers for General Applications
NEMA TC 13	(1993) Electrical Nonmetallic Tubing (ENT)
NEMA TC 2	(1998) Electrical Polyvinyl Chloride (PVC) Tubing (EPT) and Conduit (EPC-40 and EPC-80)
NEMA VE 1	(1996) Metal Cable Tray Systems
NEMA WD 1	(1999) General Requirements for Wiring Devices
NEMA WD 6	(1997) Wiring Devices - Dimensional Requirements

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	(2000) Life Safety Code
NFPA 70	(2002) National Electrical Code

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

47 CFR 18	Industrial, Scientific, and Medical Equipment
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## UNDERWRITERS LABORATORIES (UL)

UL 1	(2000) Flexible Metal Conduit
UL 1004	(1994; Rev thru Nov 1999) Electric Motors
UL 1010	(1995; Rev thru Mar 1999) Receptical-Plug Combinations for Use in Hazardous (Classified) Locations
UL 1022	(1998) Line Isolation Monitors
UL 1029	(1994; Rev thru Dec 1997) High-Intensity-Discharge Lamp Ballasts
UL 1047	(1995; Rev Jul 1998) Isolated Power Systems Equipment
UL 1236	(1994; Rev thru Mar 1999) Battery Chargers for Charging Engine-Starter Batteries
UL 1242	(1996; Rev Mar 1998) Intermediate Metal Conduit

UL 1449	(1996; Rev thru Dec 1999) Transient Voltage Surge Suppressors
UL 1564	(1993; R Sep 1998) Industrial Battery Chargers
UL 1569	(1999; Rev thru Jan 2000) Metal-Clad Cables
UL 1570	(1995; Rev thru Nov 1999) Fluorescent Lighting Fixtures
UL 1571	(1995; Rev thru Nov 1999) Incandescent Lighting Fixtures
UL 1572	(1995; Rev thru Nov 1999) High Intensity Discharge Lighting Fixtures
UL 1660	(2000) Liquid-Tight Flexible Nonmetallic Conduit
UL 198B	(1995) Class H Fuses
UL 198C	(1986; Rev thru Feb 1998) High-Interrupting-Capacity Fuses, Current-Limiting Types
UL 198D	(1995) Class K Fuses
UL 198E	(1988; Rev Jul 1988) Class R Fuses
UL 198G	(1988; Rev May 1988) Fuses for Supplementary Overcurrent Protection
UL 198H	(1988; Rev thru Nov 1993) Class T Fuses
UL 198L	(1995; Rev May 1995) D-C Fuses for Industrial Use
UL 20	(1995; Rev thru Oct 1998) General-Use Snap Switches
UL 360	(1996; Rev thru Oct 1997) Liquid-Tight Flexible Steel Conduit
UL 4	(1996) Armored Cable
UL 44	(1999) Thermoset-Insulated Wires and Cables
UL 467	(1993; Rev thru Apr 1999) Grounding and Bonding Equipment
UL 486A	(1997; Rev thru Dec 1998) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 486B	(1997; Rev Jun 1997) Wire Connectors for Use with Aluminum Conductors
UL 486C	(1997; Rev thru Aug 1998) Splicing Wire

## Connectors

UL 486E	(1994; Rev thru Feb 1997) Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
UL 489	(1996; Rev thru Dec 1998) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 498	(1996; Rev thru Jan 1999) Attachment Plugs and Receptacles
UL 5	(1996) Surface Metal Raceways and Fittings
UL 50	(1995; Rev thru Nov 1999) Enclosures for Electrical Equipment
UL 506	(1994; R Oct 1997) Specialty Transformers
UL 508	(1999) Industrial Control Equipment
UL 510	(1994; Rev thru Apr 1998) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape
UL 512	(1993; Rev thru Mar 1999) Fuseholders
UL 514A	(1996; Rev Dec 1999) Metallic Outlet Boxes
UL 514B	(1997; Rev Oct 1998) Fittings for Cable and Conduit
UL 514C	(1996; Rev thru Dec 1999) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 542	(1999) Lampholders, Starters, and Starter Holders for Fluorescent Lamps
UL 6	(1997) Rigid Metal Conduit
UL 651	(1995; Rev thru Oct 1998) Schedule 40 and 80 Rigid PVC Conduit
UL 651A	(1995; Rev thru Apr 1998) Type EB and A Rigid PVC Conduit and HDPE Conduit
UL 67	(1993; Rev thru Oct 1999) Panelboards
UL 674	(1994; Rev thru Oct 1998) Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations
UL 698	(1995; Rev thru Mar 1999) Industrial Control Equipment for Use in Hazardous (Classified) Locations
UL 719	(1996; Rev Jul 1999) Nonmetallic-Sheathed

## Cables

UL 797	(1993; Rev thru Mar 1997) Electrical Metallic Tubing
UL 817	(1994; Rev thru May 1999) Cord Sets and Power-
UL 83	(1998; Rev thru Sep 1999) Thermoplastic-Insulated Wires and Cables
UL 844	(1995; Rev thru Mar 1999) Electric Lighting Fixtures for Use in Hazardous (Classified) Locations
UL 845	(1995; Rev thru Nov 1999) Motor Control Centers
UL 854	(1996; Rev Oct 1999) Service-Entrance Cables
UL 857	(1994; Rev thru Dec 1999) Busways and Associated Fittings
UL 869A	(1998) Reference Standard for Service Equipment
UL 877	(1993; Rev thru Nov 1999) Circuit Breakers and Circuit-Breaker Enclosures for Use in Hazardous (Classified) Locations
UL 886	(1994; Rev thru Apr 1999) Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations
UL 891	(1994; Rev thru Jan 1995) Dead-Front Switchboards
UL 916	(1998) Energy Management Equipment
UL 924	(1995; Rev thru Oct 97) Emergency Lighting and Power Equipment
UL 935	(1995; Rev thru Oct 1998) Fluorescent-Lamp Ballasts
UL 943	(1993; Rev thru May 1998) Ground-Fault Circuit-Interrupters
UL 98	(1994; Rev thru Jun 1998) Enclosed and Dead-Front Switches
UL Elec Const Dir	(1999) Electrical Construction Equipment Directory

## 1.2 GENERAL

## 1.2.1 Rules

The installation shall conform to the requirements of NFPA 70 and NFPA 101, unless more stringent requirements are indicated or shown.

#### 1.2.2 Coordination

The drawings indicate the extent and the general location and arrangement of equipment, conduit, and wiring. The Contractor shall become familiar with all details of the work and verify all dimensions in the field so that the outlets and equipment shall be properly located and readily accessible.

Lighting fixtures, outlets, and other equipment and materials shall be carefully coordinated with mechanical or structural features prior to installation and positioned according to architectural reflected ceiling plans; otherwise, lighting fixtures shall be symmetrically located according to the room arrangement when uniform illumination is required, or asymmetrically located to suit conditions fixed by design and shown. Raceways, junction and outlet boxes, and lighting fixtures shall not be supported from sheet metal roof decks. If any conflicts occur necessitating departures from the drawings, details of and reasons for departures shall be submitted and approved prior to implementing any change. The Contractor shall coordinate the electrical requirements of the mechanical work and provide all power related circuits, wiring, hardware and structural support, even if not shown on the drawings.

#### 1.2.3 Special Environments

##### 1.2.3.1 Weatherproof Locations

Wiring, Fixtures, and equipment in designated locations shall conform to NFPA 70 requirements for installation in damp or wet locations.

##### 1.2.3.2 Ducts, Plenums and Other Air-Handling Spaces

Wiring and equipment in ducts, plenums and other air-handling spaces shall be installed using materials and methods in conformance with NFPA 70 unless more stringent requirements are indicated in this specification or on the contract drawings.

#### 1.2.4 Standard Products

Material and equipment shall be a standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

#### 1.2.5 Nameplates

##### 1.2.5.1 Identification Nameplates

Major items of electrical equipment and major components shall be permanently marked with an identification name to identify the equipment by type or function and specific unit number as indicated. Designation of motors shall coincide with their designation in the motor control center or panel. Unless otherwise specified, identification nameplates shall be made of laminated plastic in accordance with ASTM D 709 with black outer layers and a white core. Edges shall be chamfered. Plates shall be fastened with black-finished round-head drive screws, except motors, or approved nonadhesive metal fasteners. When the nameplate is to be installed on an irregular-shaped object, the Contractor shall devise an approved support suitable for the application and ensure the proper installation of the

supports and nameplates. In all instances, the nameplate shall be installed in a conspicuous location. At the option of the Contractor, the equipment manufacturer's standard embossed nameplate material with black paint-filled letters may be furnished in lieu of laminated plastic. The front of each panelboard, motor control center, switchgear, and switchboard shall have a nameplate to indicate the phase letter, corresponding color and arrangement of the phase conductors. The following equipment, as a minimum, shall be provided with identification nameplates:

Minimum 1/4 inch High Letters	Minimum 1/8 inch High Letters
Panelboards	Control Power Transformers
Starters	Control Devices
Safety Switches	Instrument Transformers
Motor Control Centers	
Transformers	
Equipment Enclosures	
Switchgear	
Switchboards	
Motors	

Each panel, section, or unit in motor control centers, switchgear or similar assemblies shall be provided with a nameplate in addition to nameplates listed above, which shall be provided for individual compartments in the respective assembly, including nameplates which identify "future," "spare," and "dedicated" or "equipped spaces."

#### 1.2.5.2 Liquid-Filled Transformer Nameplates

Power transformers shall be provided with Nameplate C information in accordance with IEEE C57.12.00. Nameplates shall indicate percent impedance, voltage, kVA, frequency, number of phases, cooling class, insulation class, temperature rise, the number of gallons and composition of liquid-dielectric, and shall be permanently marked with a statement that the transformer dielectric to be supplied is non-polychlorinated biphenyl. The Contractor shall furnish manufacturer's certification for each transformer that the dielectric is non-PCB classified, with less than 502 ppm PCB content in accordance with paragraph LIQUID DIELECTRICS. Certifications shall be related to serial numbers on transformer nameplates. Transformer dielectric exceeding the 502 ppm PCB content or transformers without certification will be considered as PCB insulated and will not be accepted.

#### 1.2.6 As-Built Drawings

Following the project completion or turnover, within 30 days the Contractor shall furnish 2 sets of as-built drawings to the Contracting Officer.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

## Interior Electrical Equipment; G-DO

Detail drawings consisting of equipment drawings, illustrations, schedules, instructions, diagrams, and other information necessary to define the installation. Detail drawings shall show the rating of items and systems and how the components of an item and system are assembled, function together, and how they will be installed on the project. Data and drawings for component parts of an item or system shall be coordinated and submitted as a unit. Data and drawings shall be coordinated and included in a single submission.

Multiple submissions for the same equipment or system are not acceptable except where prior approval has been obtained from the Contracting Officer. In such cases, a list of data to be submitted later shall be included with the first submission. Detail drawings shall show physical arrangement, construction details, connections, finishes, materials used in fabrication, provisions for conduit or busway entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and equipment weight. Drawings shall be drawn to scale and/or dimensioned. Optional items shall be clearly identified as included or excluded. Detail drawings shall as a minimum include:

- a. Transformers.
- b. Switchgear.
- c. Motors and rotating machinery.
- d. Motor control centers.
- e. Single line electrical diagrams including primary, metering, sensing and relaying, control wiring, and control logic.

Structural drawings showing the structural or physical features of major equipment items, components, assemblies, and structures, including foundations or other types of supports for equipment and conductors. These drawings shall include accurately scaled or dimensioned outline and arrangement or layout drawings to show the physical size of equipment and components and the relative arrangement and physical connection of related components. Weights of equipment, components and assemblies shall be provided when required to verify the adequacy of design and proposed construction of foundations or other types of supports. Dynamic forces shall be stated for switching devices when such forces must be considered in the design of support structures. The appropriate detail drawings shall show the provisions for leveling, anchoring, and connecting all items during installation, and shall include any recommendations made by the manufacturer.

Electrical drawings including single-line and three-line diagrams, and schematics or elementary diagrams of each electrical system; internal wiring and field connection diagrams of each electrical device when published by the manufacturer; wiring diagrams of cabinets, panels, units, or separate mountings; interconnection diagrams that show the wiring between separate components of assemblies; field connection diagrams that show the termination of wiring routed between separate items of equipment; internal wiring diagrams of equipment showing wiring as actually

provided for this project. Field wiring connections shall be clearly identified.

If departures from the contract drawings are deemed necessary by the Contractor, complete details of such departures, including changes in related portions of the project and the reasons why, shall be submitted with the detail drawings. Approved departures shall be made at no additional cost to the Government.

#### SD-03 Product Data

##### Fault Current and Protective Device Coordination Study; G-D0

The study shall be submitted along with protective device equipment submittals. No time extensions or similar contract modifications will be granted for work arising out of the requirements for this study. Approval of protective devices proposed shall be based on recommendations of this study. The Government shall not be held responsible for any changes to equipment, device ratings, settings, or additional labor for installation of equipment or devices ordered and/or procured prior to approval of the study.

##### Manufacturer's Catalog; G-D0

Data composed of catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.

##### Material, Equipment, and Fixture Lists; G-A0

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each entry shall include an item number, the quantity of items proposed, and the name of the manufacturer of each item.

##### Installation Procedures; G-A0

Installation procedures for rotating equipment, transformers, switchgear, battery systems, voltage regulators, and grounding resistors. Procedures shall include diagrams, instructions, and precautions required to install, adjust, calibrate, and test devices and equipment.

##### Onsite Tests; G-A0

A detailed description of the Contractor's proposed procedures for on-site tests.

##### Field Test Plan; G-A0

A detailed description of the Contractor's proposed procedures for onsite test submitted 20 days prior to testing the installed system. No field test will be performed until the test plan is approved. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits.

## Field Test Reports; G-AO

Six copies of the information described below in 8 1/2 x 11 inch binders having a minimum of 5 rings from which material may readily be removed and replaced, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

- a. A list of equipment used, with calibration certifications.
- b. A copy of measurements taken.
- c. The dates of testing.
- d. The equipment and values to be verified.
- e. The conditions specified for the test.
- f. The test results, signed and dated.
- g. A description of adjustments made.
- h. Final position of controls and device settings.

## SD-07 Certificates

## Materials and Equipment; G-AO

The label or listing of the Underwriters Laboratories, Inc., will be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this label or listing, a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with required procedures and that the materials and equipment comply with all contract requirements will be accepted. However, materials and equipment installed in hazardous locations must bear the UL label unless the data submitted from other testing agency is specifically approved in writing by the Contracting Officer. Items which are required to be listed and labeled in accordance with Underwriters Laboratories must be affixed with a UL label that states that it is UL listed. No exceptions or waivers will be granted to this requirement. Materials and equipment will be approved based on the manufacturer's published data.

For other than equipment and materials specified to conform to UL publications, a manufacturer's statement indicating complete compliance with the applicable standard of the American Society for Testing and Materials, National Electrical Manufacturers Association, or other commercial standard, is acceptable.

## 1.4 WORKMANSHIP

Materials and equipment shall be installed in accordance with NFPA 70, recommendations of the manufacturer, and as shown.

## PART 2 PRODUCTS

Products shall conform to the respective publications and other requirements specified below. Materials and equipment not listed below shall be as specified elsewhere in this section. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

## 2.1 CABLES AND WIRES

Conductors No. 8 AWG and larger diameter shall be stranded. Conductors No. 10 AWG and smaller diameter shall be solid, except that conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3, shall be stranded unless specifically indicated otherwise. Conductor sizes and ampacities shown are based on copper, unless indicated otherwise. All conductors shall be copper.

### 2.1.1 Equipment Manufacturer Requirements

When manufacturer's equipment requires copper conductors at the terminations or requires copper conductors to be provided between components of equipment, provide copper conductors or splices, splice boxes, and other work required to meet manufacturer's requirements.

### 2.1.2 Aluminum Conductors

Aluminum conductors shall not be used.

### 2.1.3 Insulation

Unless indicated otherwise, or required by NFPA 70, power and lighting wires shall be 600-volt, Type THWN, THHN, or THW conforming to UL 83 or RHW conforming to UL 44, except that grounding wire may be type TW conforming to UL 83; remote-control and signal circuits shall be Type TW, THW or TF, conforming to UL 83. Where lighting fixtures require 90-degree Centigrade (C) conductors, provide only conductors with 90-degree C insulation or better.

### 2.1.4 Bonding Conductors

ASTM B 1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B 8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

### 2.1.5 Service Entrance Cables

Service entrance (SE) and underground service entrance (USE) cables, UL 854.

### 2.1.6 Cord Sets and Power-Supply Cords

UL 817.

## 2.2 CABLE TRAYS

Cable tray shall conform to NEMA VE 1, shall form a wireway system, and shall be of nominal 46 inch depth. Cable trays shall be constructed of aluminum. Trays shall include splice and end plates, dropouts, and miscellaneous hardware. Edges, fittings, and hardware shall be finished free from burrs and sharp edges. Fittings shall have not less than the load-carrying ability of straight tray sections and shall have manufacturer's minimum standard radius. Radius of bends shall be as

indicated on the drawings.

#### 2.2.1 Ladder

Ladder-type cable trays shall be of nominal 12 inch width. Rung spacing shall be on 9 inch maximum centers.

### 2.3 TRANSIENT VOLTAGE SURGE PROTECTION

Transient voltage surge suppressors shall be provided as indicated. Surge suppressors shall meet the requirements of IEEE C62.41 and be UL listed and labeled as having been tested in accordance with UL 1449. Surge suppressor ratings shall be as indicated. Fuses shall not be used as surge suppression.

### 2.4 CIRCUIT BREAKERS

#### 2.4.1 MOLDED-CASE CIRCUIT BREAKERS

Molded-case circuit breakers shall conform to NEMA AB 1 and UL 489. Circuit breakers may be installed in panelboards, switchboards, enclosures and motor control centers.

##### 2.4.1.1 Construction

Circuit breakers shall be suitable for mounting and operating in any position. Lug shall be listed for copper conductors only in accordance with UL 486E. Single-pole circuit breakers shall be full module size with not more than one pole per module. Multi-pole circuit breakers shall be of the common-trip type having a single operating handle such that an overload or short circuit on any one pole will result in all poles opening simultaneously. Sizes of 100 amperes or less may consist of single-pole breakers permanently factory assembled into a multi-pole unit having an internal, mechanical, nontamperable common-trip mechanism and external handle ties. All circuit breakers shall have a quick-make, quick-break overcenter toggle-type mechanism, and the handle mechanism shall be trip-free to prevent holding the contacts closed against a short-circuit or sustained overload. All circuit breaker handles shall assume a position between "ON" and "OFF" when tripped automatically. All ratings shall be clearly visible.

##### 2.4.1.2 Ratings

Voltage ratings shall be not less than the applicable circuit voltage. The interrupting rating of the circuit breakers shall be at least equal to the available short-circuit current at the line terminals of the circuit breaker and correspond to the UL listed integrated short-circuit current rating specified for the panelboards and switchboards. Molded-case circuit breakers shall have nominal voltage ratings, maximum continuous-current ratings, and maximum short-circuit interrupting ratings in accordance with NEMA AB 1. Ratings shall be coordinated with system X/R ratio.

##### 2.4.1.3 Thermal-Magnetic Trip Elements

Thermal magnetic circuit breakers shall be provided as shown. Automatic operation shall be obtained by means of thermal-magnetic tripping devices located in each pole providing inverse time delay and instantaneous circuit protection. The instantaneous magnetic trip shall be adjustable and accessible from the front of all circuit breakers on frame sizes 800

amperes and above.

#### 2.4.2 Ground Fault Circuit Interrupters

UL 943. Breakers equipped with ground fault circuit interrupters shall have ground fault class, interrupting capacity, and voltage and current ratings as indicated.

### 2.5 CONDUIT AND TUBING

#### 2.5.1 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)

UL 797

#### 2.5.2 Flexible Conduit, Steel and Plastic

General-purpose type, UL 1; liquid tight, UL 360, and UL 1660.

#### 2.5.3 Intermediate Metal Conduit

UL 1242.

#### 2.5.4 PVC Coated Rigid Steel Conduit

NEMA RN 1.

#### 2.5.5 Rigid Aluminum Conduit

ANSI C80.5 and UL 6.

#### 2.5.6 Rigid Metal Conduit

UL 6.

#### 2.5.7 Surface Metal Electrical Raceways and Fittings

UL 5.

### 2.6 CONDUIT AND DEVICE BOXES AND FITTINGS

#### 2.6.1 Boxes, Metallic Outlet

NEMA OS 1 and UL 514A.

#### 2.6.2 Boxes, Switch (Enclosed), Surface-Mounted

UL 98.

#### 2.6.3 Fittings for Conduit and Outlet Boxes

UL 514B.

### 2.7 CONDUIT COATINGS PLASTIC RESIN SYSTEM

NEMA RN 1, Type A-40.

### 2.8 CONNECTORS, WIRE PRESSURE

#### 2.8.1 For Use With Copper Conductors

UL 486A.

## 2.9 ELECTRICAL GROUNDING AND BONDING EQUIPMENT

UL 467.

### 2.9.1 Ground Rods

Ground rods shall be of copper-clad steel conforming to UL 467 3/4 inch in diameter by 10 feet in length of the sectional type driven full length into the earth.

### 2.9.2 Ground Bus

The ground bus shall be bare conductor or flat copper in one piece, if practicable.

## 2.10 ENCLOSURES

NEMA ICS 6 or NEMA 250 unless otherwise specified.

### 2.10.1 Cabinets and Boxes

Cabinets and boxes with volume greater than 100 cubic inches shall be in accordance with UL 50, hot-dip, zinc-coated, if sheet steel.

### 2.10.2 Circuit Breaker Enclosures

UL 489.

## 2.11 LIGHTING FIXTURES, LAMPS, BALLASTS, EMERGENCY EQUIPMENT, CONTROLS AND ACCESSORIES

The following specifications are supported and supplemented by information and details on the drawings. Additional fixtures, if shown, shall conform to this specification. Lamps, lampholders, ballasts, transformers, electronic circuitry and other lighting system components shall be constructed according to industry standards. Equipment shall be tested and listed by a recognized independent testing laboratory for the expected installation conditions. Equipment shall conform to the standards listed below.

### 2.11.1 Lamps

Lamps shall be constructed to operate in the specified fixture, and shall function without derating life or output as listed in published data. Lamps shall meet the requirements of the Energy Policy Act of 1992.

- a. Incandescent and tungsten halogen lamps shall be designed for 125 volt operation (except for low voltage lamps), shall be rated for minimum life of 2,000 hours, and shall have color temperature between 2,800 and 3,200 degrees Kelvin. Tungsten halogen lamps shall incorporate quartz capsule construction. Lamps shall comply with ANSI C78.20 and sections 238 and 270 of ANSI C78.21.
- b. Fluorescent lamps shall be green-tipped and shall have color temperature of 3,500 degrees Kelvin or as shown. They shall be designed to operate with the ballasts and circuitry of the

fixtures in which they will be used. Fluorescent lamps, including spares, shall be manufactured by one manufacturer to provide for color and performance consistency. Fluorescent lamps shall comply with ANSI C78.1. Fluorescent tube lamp efficiencies shall meet or exceed the following requirements.

T8, 32 watts	(4' lamp)	2800 lumens
T8,59 watts	(8' lamp)	5700 lumens
T8/U,31-32 watts	(U-tube)	2600 lumens

(1) Linear fluorescent lamps, unless otherwise indicated, shall be 4 feet long 32 watt T8, 265 mA, with minimum CRI of 75. Lamps of other lengths or types shall be used only where specified or shown. Lamps shall deliver rated life when operated on rapid start ballasts or as shown.

(2) Small compact fluorescent lamps shall be twin, double, or triple tube configuration as shown with bi-pin or four-pin snap-in base and shall have minimum CRI of 85. They shall deliver rated life when operated on ballasts as shown. 9 and 13 watt double tube lamps shall comply with ANSI C78.2B. 18 and 26 watt double tube lamps shall comply with ANSI C78.2A. Minimum starting temperature shall be 32 degrees F for twin tube lamps and for double and triple twin tube lamps without internal starter; and 15 degrees F for double and triple twin tube lamps with internal starter.

(3) Long compact fluorescent lamps shall be 18, 27, 39, 40, 50, or 55 watt bi-axial type as shown with four-pin snap-in base; shall have minimum CRI of 85; and shall have a minimum starting temperature of 50 degrees F. They shall deliver rated life when operated on rapid start ballasts or as shown.

- c. High intensity discharge lamps, including spares, shall be manufactured by one manufacturer in order to provide color and performance consistency. High intensity discharge lamps shall be designed to operate with the ballasts and circuitry of the fixtures in which they will be used and shall have wattage, shape and base as shown. High intensity discharge lamps, unless otherwise shown, shall have medium or mogul screw base and minimum starting temperature of -20 degrees F. Metal halide lamps, unless otherwise shown, shall have minimum CRI of 65; color temperature of 4,300 degrees Kelvin; shall be -BU configuration if used in base-up position; and shall be -H or high output configuration if used in horizontal position. Lamps shall comply with all applicable ANSI C78.1350, ANSI C78.1351, ANSI C78.1352, ANSI C78.1355, ANSI C78.1375, and ANSI C78.1376.

#### 2.11.2 Ballasts and Transformers

Ballasts or transformers shall be designed to operate the designated lamps within their optimum specifications, without derating the lamps. Lamp and ballast combinations shall be certified as acceptable by the lamp manufacturer.

- a. Low voltage incandescent transformers shall be Class II UL listed 120/12 volt or 120/24 volt step-down transformers as required for

the lamps shown. Transformers shall be high power factor type and shall be rated for continuous operation under the specified load. Transformers shall be encased or encased and potted, and mounted integrally within the lighting fixture unless otherwise shown.

- b. Fluorescent ballasts shall comply with ANSI C82.1 and shall be mounted integrally within fluorescent fixture housing unless otherwise shown. Ballasts shall have maximum current crest factor of 1.7; high power factor; Class A sound rating; maximum operating case temperature of 77 degrees F above ambient; and shall be rated Class P. Unless otherwise indicated, the minimum number of ballasts shall be used to serve each individual fixture. A single ballast may be used to serve multiple fixtures if they are continuously mounted, identically controlled and factory manufactured for that installation with an integral wireway.

(1) Compact fluorescent ballasts shall comply with IEEE C62.41 Category A transient voltage variation requirements and shall be mounted integrally within compact fluorescent fixture housing unless otherwise shown. Ballasts shall have minimum ballast factor of 0.95; maximum current crest factor of 1.6; high power factor; maximum operating case temperature of 77 degrees F above ambient; shall be rated Class P; and shall have a sound rating of Class A. Ballasts shall meet FCC Class A specifications for EMI/RFI emissions. Ballasts shall operate from nominal line voltage of 120 volts or 277 volts at 60 Hz as indicated and maintain constant light output over a line voltage variation of  $\pm 10\%$ . Ballasts shall have an end-of-lamp-life detection and shut-down circuit. Ballasts shall be UL listed and shall contain no PCBs. Ballasts shall contain potting to secure PC board, provide lead strain relief, and provide a moisture barrier.

(2) Electronic fluorescent ballasts shall comply with 47 CFR 18 for electromagnetic interference. Ballasts shall withstand line transients per IEEE C62.41, Category A. Ballasts shall have total harmonic distortion between 10 and 20%; minimum frequency of 20,000Hz; filament voltage between 2.5 and 4.5 volts; maximum starting inrush current of 20 amperes; and shall comply with the minimum Ballast Efficacy Factors shown in the table below. Minimum starting temperature shall be 50 degrees F as shown. Ballasts shall carry a manufacturer's full warranty of three years, including a minimum \$10 labor allowance per ballast.

#### ELECTRONIC FLUORESCENT BALLAST EFFICACY FACTORS

LAMP TYPE	TYPE OF STARTER & LAMP	NOMINAL OPERATIONAL VOLTAGE	NUMBER OF LAMPS	MINIMUM BALLAST EFFICACY FACTOR
32W T8	rapid start	120 or 277 V	1	2.54
	linear & U-tubes		2	1.44
			3	0.93
			4	0.73

- (3) Dimming compact fluorescent ballasts shall be electronic and

shall comply with the applicable compact fluorescent and dimming ballast specifications shown above. Ballasts shall operate the lamps shown in the range from full rated light output to 5 percent of full rated light output. Ballast power factor shall be <90% throughout dimming range. THD shall be <10% at maximum light output and <20% at minimum light output. Ballast shall ignite the lamps at any light output setting selected.

- c. High intensity discharge ballasts shall comply with UL 1029 and, if multiple supply types, with ANSI C82.4. Ballasts shall have minimum ballast factor of 0.9; high power factor; Class A sound rating; and maximum operating case temperature of 77 degrees F above ambient.

- (1) Electronic high intensity discharge ballasts shall be constant wattage autotransformer type; shall have less than 10% ballast loss; shall have total harmonic distortion between 10 and 20%; and shall have a minimum starting temperature of 0 degrees F.

- (2) Magnetic high intensity discharge ballasts shall have a minimum starting temperature of -20 degrees F.

### 2.11.3 Fixtures

Fixtures shall be in accordance with the size, shape, appearance, finish, and performance shown. Unless otherwise indicated, lighting fixtures shall be provided with housings, junction boxes, wiring, lampholders, mounting supports, trim, hardware and accessories for a complete and operable installation. Recessed housings shall be minimum 20 gauge cold rolled or galvanized steel as shown. Extruded aluminum fixtures shall have minimum wall thickness of 0.125 inches. Plastic lenses shall be 100% virgin acrylic or as shown. Glass lenses shall be tempered. Heat resistant glass shall be borosilicate type. Conoid recessed reflector cones shall be Alzak with clear specular low iridescent finish.

- a. Fluorescent fixtures shall comply with UL 1570. Recessed ceiling fixtures shall comply with NEMA LE 4. Fixtures shall be plainly marked for proper lamp and ballast type to identify lamp diameter, wattage, color and start type. Marking shall be readily visible to service personnel, but not visible from normal viewing angles. Fluorescent fixture lens frames on recessed and surface mounted troffers shall be one assembly with mitered corners. Parabolic louvers shall have a low iridescent finish and 45 degree cut-off. Louver intersection joints shall be hairline type and shall conceal mounting tabs or other assembly methods. Louvers shall be free from blemishes, lines or defects which distort the visual surface. Integral ballast and wireway compartments shall be easily accessible without the use of special tools. Housings shall be constructed to include grounding necessary to start the lamps. Open fixtures shall be equipped with a sleeve, wire guard, or other positive means to prevent lamps from falling. Medium bi-pin lampholders shall be twist-in type with positive locking position. Long compact fluorescent fixtures and fixtures utilizing U-bend lamps shall have clamps or secondary lampholders to support the free ends of the lamps.
- b. High intensity discharge fixture shall comply with UL 1572. Recessed ceiling fixtures shall comply with NEMA LE 4. Reflectors shall be anodized aluminum. Fixtures for horizontal lamps shall

have position oriented lampholders. Lampholders shall be pulse-rated to 5,000 volts. Recessed lens fixtures shall have extruded aluminum lens frames. Ballasts shall be integral to fixtures and shall be accessible without the use of special tools. Remote ballasts shall be encased and potted. Lamps shall be shielded from direct view with a UV absorbing material such as tempered glass, and shall be circuited through a cut-off switch which will shut off the lamp circuit if the lens is not in place.

- c. Emergency lighting fixtures and accessories shall be constructed and independently tested to meet the requirements of applicable codes. Batteries shall be Nicad or equal with no required maintenance, and shall have a minimum life expectancy of five years and warranty period of three years.

- d. Exit Signs

Exit signs shall be ENERGY STAR compliant, thereby meeting the following requirements. Input power shall be less than 5 watts per face. Letter size and spacing shall adhere to NFPA 101. Luminance contrast shall be greater than 0.8. Average luminance shall be greater than 15 cd/m<sup>2</sup> measured at normal (0 degree) and 45 degree viewing angles. Minimum luminance shall be greater than 8.6 cd/m<sup>2</sup> measured at normal and 45 degree viewing angles. Maximum to minimum luminance shall be less than 20:1 measured at normal and 45 degree viewing angles. The manufacturer warranty for defective parts shall be at least 5 years.

#### 2.11.4 Lampholders, Starters, and Starter Holders

UL 542

#### 2.11.5 Ultrasonic, and Passive Infrared Occupancy Sensors

UL 916

#### 2.12 INSTRUMENTS, ELECTRICAL INDICATING

ANSI C39.1.

#### 2.13 MOTORS, AC, FRACTIONAL AND INTEGRAL

Motors, ac, fractional and integral horsepower, 500 hp and smaller shall conform to NEMA MG 1 and UL 1004 for motors; NEMA MG 10 for energy management selection of polyphase motors. In addition to the standards listed above, motors shall be provided with efficiencies as specified in the table "MINIMUM NOMINAL EFFICIENCIES" below.

##### 2.13.1 Rating

The horsepower rating of motors should be limited to no more than 125 percent of the maximum load being served unless a NEMA standard size does not fall within this range. In this case, the next larger NEMA standard motor size should be used.

##### 2.13.2 Motor Efficiencies

All permanently wired polyphase motors of 1 hp or more shall meet the minimum full-load efficiencies as indicated in the following table, and as

specified in this specification. Motors of 1 hp or more with open, drip proof or totally enclosed fan cooled enclosures shall be high efficiency type, unless otherwise indicated. Motor efficiencies indicated in the tables apply to general-purpose, single-speed, polyphase induction motors. Applications which require definite purpose, special purpose, special frame, or special mounted polyphase induction motors are excluded from these efficiency requirements. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

MINIMUM NOMINAL MOTOR EFFICIENCIES  
OPEN DRIP PROOF MOTORS

HP	1200 RPM	1800 RPM	3600 RPM
1	82.5	85.5	80.0
1.5	86.5	86.5	85.5
2	87.5	86.5	86.5
3	89.5	89.5	86.5
5	89.5	89.5	89.5
7.5	91.7	91.0	89.5
10	91.7	91.7	90.2
15	92.4	93.0	91.0
20	92.4	93.0	92.4
25	93.0	93.6	93.0
30	93.6	93.6	93.0
40	94.1	94.1	93.6
50	94.1	94.5	93.6
60	95.0	95.0	94.1
75	95.0	95.0	94.5
100	95.0	95.4	94.5
125	95.4	95.4	95.0
150	95.8	95.8	95.4
200	95.4	95.8	95.4
250	95.4	96.2	95.8
300	95.4	95.0	95.4
350	94.5	95.4	95.0
400	94.1	95.8	95.0
450	94.5	95.4	95.4
500	94.5	94.5	94.5

## 2.14 MOTOR CONTROLS AND MOTOR CONTROL CENTERS

### 2.14.1 General

NEMA ICS 1, NEMA ICS 2, NEMA ICS 3 and NEMA ICS 6, and UL 508 and UL 845. Panelboards supplying non-linear loads shall have neutrals sized for 200 percent of rated current.

### 2.14.2 Motor Starters

Combination starters shall be provided with circuit breakers as indicated.

### 2.14.3 Thermal-Overload Protection

Each motor of 1/8 hp or larger shall be provided with thermal-overload protection. Polyphase motors shall have overload protection in each

ungrounded conductor. The overload-protection device shall be provided either integral with the motor or controller, or shall be mounted in a separate enclosure. Unless otherwise specified, the protective device shall be of the manually reset type. Single or double pole tumbler switches specifically designed for alternating-current operation only may be used as manual controllers for single-phase motors having a current rating not in excess of 80 percent of the switch rating.

#### 2.14.4 Low-Voltage Motor Overload Relays

##### 2.14.4.1 General

Thermal and magnetic current overload relays shall conform to NEMA ICS 2 and UL 508. Overload protection shall be provided either integral with the motor or motor controller, and shall be rated in accordance with the requirements of NFPA 70.

##### 2.14.4.2 Construction

Manual reset type thermal relay shall be bimetallic construction. Automatic reset type thermal relays shall be bimetallic construction. Magnetic current relays shall consist of a contact mechanism and a dash pot mounted on a common frame.

##### 2.14.4.3 Ratings

Voltage ratings shall be not less than the applicable circuit voltage. Trip current ratings shall be established by selection of the replaceable overload device and shall not be adjustable. Where the controller is remotely-located or difficult to reach, an automatic reset, non-compensated overload relay shall be provided. Manual reset overload relays shall be provided otherwise, and at all locations where automatic starting is provided. Where the motor is located in a constant ambient temperature, and the thermal device is located in an ambient temperature that regularly varies by more than minus 18 degrees F, an ambient temperature-compensated overload relay shall be provided.

#### 2.14.5 Automatic Control Devices

##### 2.14.5.1 Direct Control

Automatic control devices (such as thermostats, float or pressure switches) which control the starting and stopping of motors directly shall be designed for that purpose and have an adequate horsepower rating.

##### 2.14.5.2 Pilot-Relay Control

Where the automatic-control device does not have such a rating, a magnetic starter shall be used, with the automatic-control device actuating the pilot-control circuit.

##### 2.14.5.3 Manual/Automatic Selection

- a. Where combination manual and automatic control is specified and the automatic-control device operates the motor directly, a double-throw, three-position tumbler or rotary switch (marked MANUAL-OFF-AUTOMATIC) shall be provided for the manual control.
- b. Where combination manual and automatic control is specified and

the automatic-control device actuates the pilot control circuit of a magnetic starter, the magnetic starter shall be provided with a three-position selector switch marked MANUAL-OFF-AUTOMATIC.

- c. Connections to the selector switch shall be such that; only the normal automatic regulatory control devices will be bypassed when the switch is in the Manual position; all safety control devices, such as low-or high-pressure cutouts, high-temperature cutouts, and motor-overload protective devices, shall be connected in the motor-control circuit in both the Manual and the Automatic positions of the selector switch. Control circuit connections to any MANUAL-OFF-AUTOMATIC switch or to more than one automatic regulatory control device shall be made in accordance with wiring diagram approved by the Contracting Officer unless such diagram is included on the drawings. All controls shall be 120 volts or less unless otherwise indicated.

#### 2.14.6 Motor Control Centers

Control centers shall conform to the requirements of NEMA ICS 1, NEMA ICS 2, NEMA ICS 3 and NEMA ICS 6, and UL 508 and UL 845. Control centers shall be indoor type and shall contain combination starters and other equipment as indicated. Control centers shall be NEMA ICS 2, Class I, Type B. Each control center shall be mounted on floor sills or mounting channels. Each circuit shall have a suitable metal or laminated plastic nameplate with white cut letters. Motor control centers shall be provided with a full-length ground bus bar.

#### 2.15 PANELBOARDS

Dead-front construction, NEMA PB 1 and UL 67.

#### 2.16 RECEPTACLES

##### 2.16.1 Heavy Duty Grade

NEMA WD 1. Devices shall conform to all requirements for heavy duty receptacles.

##### 2.16.2 Standard Grade

UL 498.

##### 2.16.3 Ground Fault Interrupters

UL 943, Class A or B.

##### 2.16.4 NEMA Standard Receptacle Configurations

NEMA WD 6.

- a. Duplex, 20-Ampere, 125 Volt

20-ampere, non-locking: NEMA type 5-20R, locking: NEMA type L5-20R.

- b. 20-Ampere, 125/250 Volt

Three-pole, 4-wire grounding, non-locking: NEMA type 14-20R, locking: NEMA type L14-20R.

c. 30-Ampere, 125/250 Volt

Three-pole, 4-wire grounding, non-locking: NEMA type 14-30R, locking: NEMA type L14-30R.

d. 30-Ampere, 250 Volt

Two-pole, 3-wire grounding, non-locking: NEMA type 6-30R, locking: NEMA type L6-30R. Three-pole, 4-wire grounding, non-locking: NEMA type 15-30R, locking: NEMA type L15-30R.

e. 50-Ampere, 125/250 Volt

Three-pole, 3-wire: NEMA type 10-50R. Three-pole, 4-wire grounding: NEMA type 14-50R.

## 2.17 Service Entrance Equipment

UL 869A.

## 2.18 SPLICE, CONDUCTOR

UL 486C.

## 2.19 SNAP SWITCHES

UL 20.

## 2.20 TAPES

### 2.20.1 Plastic Tape

UL 510.

### 2.20.2 Rubber Tape

UL 510.

## 2.21 TRANSFORMERS

Single and three-phase transformers shall have two windings per phase. Full-capacity standard NEMA taps shall be provided in the primary windings of transformers unless otherwise indicated. Three-phase transformers shall be configured with delta-wye windings, except as indicated. "T" connections may be used for transformers rated 15 kVA or below. Transformers supplying non-linear loads shall be UL listed as suitable for supplying such loads with a total K-factor not to exceed K-13 and have neutrals sized for 200 percent of rated current.

### 2.21.1 Transformers, Dry-Type

Transformers shall have 220 degrees C insulation system for transformers 15 kVA and greater, and shall have 180 degrees C insulation system for transformers rated 10 kVA and less, with temperature rise not exceeding 150

degrees C under full-rated load in maximum ambient temperature of 40 degrees C. Transformer of 150 degrees C temperature rise shall be capable of carrying continuously 100 percent of nameplate kVA without exceeding insulation rating.

a. 600 Volt or Less Primary:

NEMA ST 20, UL 506, general purpose, dry-type, self-cooled, ventilated. Transformers shall be provided in NEMA 1 enclosure. Transformers shall be quiet type with maximum sound level at least 3 decibels less than NEMA standard level for transformer ratings indicated.

### 2.21.2 Average Sound Level

The average sound level in decibels (dB) of transformers shall not exceed the following dB level at 12 inches for the applicable kVA rating range listed unless otherwise indicated:

kVA Range	dB Sound Level
1-50	50
51-150	55

## 2.22 INSTRUMENT TRANSFORMERS

### 2.22.1 General

Instrument transformers shall comply with ANSI C12.11 and IEEE C57.13. Instrument transformers shall be configured for mounting in/on the device to which they are applied. Polarity marks on instrument transformers shall be visually evident and shown on drawings.

### 2.22.2 Current Transformers

Unless otherwise indicated, bar, wound, or window-type transformers are acceptable; and except for window-type units installed over insulated buses, transformers shall have a BIL rating consistent with the rated BIL of the associated switchgear or electric power apparatus bushings, buses or conductors. Current transformers shall have the indicated ratios. The continuous thermal-current rating factor shall be not less than 2.0. Other thermal and mechanical ratings of current transformer and their primary leads shall be coordinated with the design of the circuit breaker and shall be not less than the momentary rating of the associated circuit breaker. Circuit protectors shall be provided across secondary leads of the current transformers to prevent the accidental open-circuiting of the transformers while energized. Each terminal of each current transformer shall be connected to a short-circuiting terminal block in the circuit interrupting mechanism cabinet, power transformer terminal cabinet, and in the associated instrument and relay cabinets.

#### 2.22.2.1 Current Transformers for kWh and Demand Metering (Low Voltage)

Current transformers shall conform to IEEE C57.13. Provide current transformers with a metering accuracy Class of 0.3 through B-0.5, with a minimum RF of 2 at 30 degrees C, with 600-volt insulation, and 10 kV BIL. Provide butyl-molded, window-type current transformers mounted on the transformer low-voltage bushings. Route current transformer leads in a location as remote as possible from the power transformer secondary cables

to permit current measurements to be taken with hook-on-ammeters.

#### 2.22.2.2 Voltage Transformers

Voltage transformers shall have indicated ratios. Units shall have an accuracy class rating of 0.3. Voltage transformers shall be of the drawout type having current-limiting fuses in both primary and secondary circuits. Mechanical interlocks shall prevent removal of fuses, unless the associated voltage transformer is in a drawout position. Voltage transformer compartments shall have hinged doors.

#### 2.23 WIRING DEVICES

NEMA WD 1 for wiring devices, and NEMA WD 6 for dimensional requirements of wiring devices.

#### 2.24 COORDINATED POWER SYSTEM PROTECTION

Analyses shall be prepared to demonstrate that the equipment and system constructed meet the specified requirements for equipment ratings, coordination, and protection. They shall include a load flow analysis, a fault current analysis, and protective device coordination study. The studies shall be performed by a registered professional engineer with demonstrated experience in power system coordination in the last three years. The Contractor shall provide a list of references complete with points of contact, addresses and telephone numbers. The selection of the engineer is subject to the approval of the Contracting Officer.

##### 2.24.1 Scope of Analyses

The fault current analysis, and protective device coordination study shall begin at: the nearest upstream device in the existing source system and extend through the downstream devices at the load end.

##### 2.24.2 Determination of Facts

The time-current characteristics, features, and nameplate data for each existing protective device shall be determined and documented. The Contractor shall coordinate with the commercial power company Valley Electric Company: Mr. Larry Tade, Phone # (800) 877-2157 or (406) 228-9351 for fault current availability at the site.

##### 2.24.3 Single Line Diagram

A single line diagram shall be prepared to show the electrical system buses, devices, transformation points, and all sources of fault current (including generator and motor contributions). A fault-impedance diagram or a computer analysis diagram may be provided. Each bus, device or transformation point shall have a unique identifier. If a fault-impedance diagram is provide, impedance data shall be shown. Locations of switches, breakers, and circuit interrupting devices shall be shown on the diagram together with available fault data, and the device interrupting rating.

##### 2.24.4 Fault Current Analysis

###### 2.24.4.1 Method

The fault current analysis shall be performed in accordance with methods described in IEEE Std 242, and IEEE Std 399.

#### 2.24.4.2 Data

Actual data shall be utilized in fault calculations. Bus characteristics and transformer impedances shall be those proposed. Data shall be documented in the report.

#### 2.24.4.3 Fault Current Availability

Balanced three-phase fault, bolted line-to-line fault, and line-to-ground fault current values shall be provided at each voltage transformation point and at each power distribution bus. The maximum and minimum values of fault available at each location shall be shown in tabular form on the diagram or in the report.

#### 2.24.5 Coordination Study

The study shall demonstrate that the maximum possible degree of selectivity has been obtained between devices specified, consistent with protection of equipment and conductors from damage from overloads and fault conditions. The study shall include a description of the coordination of the protective devices in this project. Provide a written narrative that describes: which devices may operate in the event of a fault at each bus; the logic used to arrive at device ratings and settings; situation where system coordination is not achievable due to device limitations (an analysis of any device curves which order overlap); coordination between upstream and downstream devices; and relay settings. Recommendations to improve or enhance system reliability, and detail where such changes would involve additions or modifications to the contract and cost changes (addition or reduction) shall be provided. Composite coordination plots shall be provided on log-log graph paper. The coordination study shall be coordinated with Specification Section 16375A, ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

#### 2.24.6 Study Report

- a. The report shall include a narrative: the analyses performed; the bases and methods used; and the desired method of coordinated protection of the power system.
- b. The study shall include descriptive and technical data for existing devices and new protective devices proposed. The data shall include manufacturers published data, nameplate data, and definition of the fixed or adjustable features of the existing or new protective devices.
- c. The report shall document utility company data including system voltages, fault MVA, system X/R ratio, time-current characteristic curves, current transformer ratios, and relay device curves and protective device ratings and settings.
- d. The report shall contain fully coordinated composite time-current characteristic curves for each bus in the system, as required to ensure coordinated power system protection between protective devices or equipment. The report shall include recommended ratings and settings of all protective devices in tabulated form.
- e. The report shall provide the calculations performed for the analyses, including computer analysis programs utilized. The name of the software package, developer, and version number shall be

provided.

## PART 3 EXECUTION

### 3.1 GROUNDING

Grounding shall be in conformance with NFPA 70, the contract drawings, and the following specifications.

#### 3.1.1 Ground Rods

The resistance to ground shall be measured using the fall-of-potential method described in IEEE Std 81. The maximum resistance of a driven ground shall not exceed 25 ohms under normally dry conditions. If this resistance cannot be obtained with a single rod, two additional rods not less than 6 feet on centers, or if sectional type rods are used, two additional sections may be coupled and driven with the first rod. In high-ground-resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately. Connections below grade shall be fusion welded. Connections above grade shall be fusion welded or shall use UL 467 approved connectors.

#### 3.1.2 Ground Bus

Ground bus shall be provided in the electrical equipment rooms as indicated. Noncurrent-carrying metal parts of transformer neutrals and other electrical equipment shall be effectively grounded by bonding to the ground bus. The ground bus shall be bonded to both the entrance ground, and to a ground rod or rods as specified above having the upper ends terminating approximately 4 inches above the floor. Connections and splices shall be of the brazed, welded, bolted, or pressure-connector type, except that pressure connectors or bolted connections shall be used for connections to removable equipment.

#### 3.1.3 Grounding Conductors

A green equipment grounding conductor, sized in accordance with NFPA 70 shall be provided, regardless of the type of conduit. Equipment grounding bars shall be provided in all panelboards. The equipment grounding conductor shall be carried back to the service entrance grounding connection or separately derived grounding connection. All equipment grounding conductors, including metallic raceway systems used as such, shall be bonded or joined together in each wiring box or equipment enclosure. Metallic raceways and grounding conductors shall be checked to assure that they are wired or bonded into a common junction. Metallic boxes and enclosures, if used, shall also be bonded to these grounding conductors by an approved means per NFPA 70. When switches, or other utilization devices are installed, any designated grounding terminal on these devices shall also be bonded to the equipment grounding conductor junction with a short jumper.

### 3.2 WIRING METHODS

Wiring shall conform to NFPA 70, the contract drawings, and the following specifications. Unless otherwise indicated, wiring shall consist of insulated conductors installed in rigid aluminum conduit, rigid zinc-coated steel conduit, electrical metallic tubing or intermediate metal conduit conduit. Where cables and wires are installed in cable trays, they shall

be of the type permitted by NFPA 70 for use in such applications. Wire fill in conduits shall be based on NFPA 70 for the type of conduit and wire insulations specified.

### 3.2.1 Conduit and Tubing Systems

Conduit and tubing systems shall be installed as indicated. Conduit sizes shown are based on use of copper conductors with insulation types as described in paragraph WIRING METHODS. Minimum size of raceways shall be 1/2 inch. Only metal conduits will be permitted when conduits are required for shielding or other special purposes indicated, or when required by conformance to NFPA 70. Electrical metallic tubing (EMT) may be installed only within buildings. EMT may be installed in concrete and grout in dry locations. EMT installed in concrete or grout shall be provided with concrete tight fittings. EMT shall not be installed in damp or wet locations, or the air space of exterior masonry cavity walls. Bushings, manufactured fittings or boxes providing equivalent means of protection shall be installed on the ends of all conduits and shall be of the insulating type, where required by NFPA 70. Only UL listed adapters shall be used to connect EMT to rigid metal conduit, cast boxes, and conduit bodies. Aluminum conduit may be used only where installed exposed in dry locations. Nonaluminum sleeves shall be used where aluminum conduit passes through concrete floors and firewalls. Penetrations of above grade floor slabs, time-rated partitions and fire walls shall be firestopped in accordance with Section 07840A FIRESTOPPING. Except as otherwise specified, IMC may be used as an option for rigid steel conduit in areas as permitted by NFPA 70. Raceways shall not be installed under the firepits of boilers and furnaces and shall be kept 6 inches away from parallel runs of flues, steam pipes and hot-water pipes. Raceways shall be concealed within finished walls, ceilings, and floors unless otherwise shown. Raceways crossing structural expansion joints or seismic joints shall be provided with suitable expansion fittings or other suitable means to compensate for the building expansion and contraction and to provide for continuity of grounding. Wiring installed in underfloor raceway system shall be suitable for installation in wet locations.

#### 3.2.1.1 Pull Wires

A pull wire shall be inserted in each empty raceway in which wiring is to be installed if the raceway is more than 50 feet in length and contains more than the equivalent of two 90-degree bends, or where the raceway is more than 150 feet in length. The pull wire shall be of No. 14 AWG zinc-coated steel, or of plastic having not less than 200 pounds per square inch tensile strength. Not less than 10 inches of slack shall be left at each end of the pull wire.

#### 3.2.1.2 Conduit Stub-Ups

Where conduits are to be stubbed up through concrete floors, a short elbow shall be installed below grade to transition from the horizontal run of conduit to a vertical run. A conduit coupling fitting, threaded on the inside shall be installed, to allow terminating the conduit flush with the finished floor. Wiring shall be extended in rigid threaded conduit to equipment, except that where required, flexible conduit may be used 6 inches above the floor. Empty or spare conduit stub-ups shall be plugged flush with the finished floor with a threaded, recessed plug.

#### 3.2.1.3 Below Slab-on-Grade or in the Ground

Electrical wiring below slab-on-grade shall be protected by a conduit system. Conduit passing vertically through slabs-on-grade shall be rigid steel or IMC. Rigid steel or IMC conduits installed below slab-on-grade or in the earth shall be field wrapped with 0.010 inch thick pipe-wrapping plastic tape applied with a 50 percent overlay, or shall have a factory-applied polyvinyl chloride, plastic resin, or epoxy coating system.

#### 3.2.1.4 Installing in Slabs Including Slabs on Grade

Conduit installed in slabs-on-grade shall be rigid steel or IMC. Conduits shall be installed as close to the middle of concrete slabs as practicable without disturbing the reinforcement. Outside diameter shall not exceed 1/3 of the slab thickness and conduits shall be spaced not closer than 3 diameters on centers except at cabinet locations where the slab thickness shall be increased as approved by the Contracting Officer. Where conduit is run parallel to reinforcing steel, the conduit shall be spaced a minimum of one conduit diameter away but not less than one inch from the reinforcing steel.

#### 3.2.1.5 Changes in Direction of Runs

Changes in direction of runs shall be made with symmetrical bends or cast-metal fittings. Field-made bends and offsets shall be made with an approved hickey or conduit-bending machine. Crushed or deformed raceways shall not be installed. Trapped raceways in damp and wet locations shall be avoided where possible. Lodgment of plaster, dirt, or trash in raceways, boxes, fittings and equipment shall be prevented during the course of construction. Clogged raceways shall be cleared of obstructions or shall be replaced.

#### 3.2.1.6 Supports

Metallic conduits and tubing, and the support system to which they are attached, shall be securely and rigidly fastened in place to prevent vertical and horizontal movement at intervals of not more than 10 feet and within 3 feet of boxes, cabinets, and fittings, with approved pipe straps, wall brackets, conduit clamps, conduit hangers, threaded C-clamps, beam clamps, or ceiling trapeze. Loads and supports shall be coordinated with supporting structure to prevent damage or deformation to the structure. Loads shall not be applied to joist bridging. Attachment shall be by wood screws or screw-type nails to wood; by toggle bolts on hollow masonry units; by expansion bolts on concrete or brick; by machine screws, welded threaded studs, heat-treated or spring-steel-tension clamps on steel work. Nail-type nylon anchors or threaded studs driven in by a powder charge and provided with lock washers and nuts may be used in lieu of expansion bolts or machine screws. Raceways or pipe straps shall not be welded to steel structures. Cutting the main reinforcing bars in reinforced concrete beams or joists shall be avoided when drilling holes for support anchors. Holes drilled for support anchors, but not used, shall be filled. In partitions of light steel construction, sheet-metal screws may be used. Raceways shall not be supported using wire or nylon ties. Raceways shall be independently supported from the structure. Upper raceways shall not be used as a means of support for lower raceways. Supporting means shall not be shared between electrical raceways and mechanical piping or ducts. Cables and raceways shall not be supported by ceiling grids. Except where permitted by NFPA 70, wiring shall not be supported by ceiling support systems. Conduits shall be fastened to sheet-metal boxes and cabinets with two locknuts where required by NFPA 70, where insulating bushings are used, and where bushings cannot be brought into firm contact with the box;

otherwise, a single locknut and bushing may be used. Threadless fittings for electrical metallic tubing shall be of a type approved for the conditions encountered. Additional support for horizontal runs is not required when EMT rests on steel stud cutouts.

#### 3.2.1.7 Exposed Raceways

Exposed raceways shall be installed parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. Raceways under raised floors and above accessible ceilings shall be considered as exposed installations in accordance with NFPA 70 definitions.

#### 3.2.1.8 Communications Raceways

Communications raceways indicated shall be installed in accordance with the previous requirements for conduit and tubing and with the additional requirement that no length of run shall exceed 50 feet for 1/2 inch and 3/4 inch sizes, and 100 feet for 1 inch or larger sizes, and shall not contain more than two 90-degree bends or the equivalent. Additional pull or junction boxes shall be installed to comply with these limitations whether or not indicated. Inside radii of bends in conduits of 1 inch size or larger shall not be less than ten times the nominal diameter.

#### 3.2.2 Cable Trays

Cable trays shall be supported in accordance with the recommendations of the manufacturer but at no more than 6 foot intervals. Contact surfaces of aluminum connections shall be coated with an antioxidant compound prior to assembly. Adjacent cable tray sections shall be bonded together by connector plates of an identical type as the cable tray sections. The Contractor shall submit the manufacturer's certification that the cable tray system meets all requirements of Article 318 of NFPA 70. The cable tray shall be installed and grounded in accordance with the provisions of Article 318 of NFPA 70. Data submitted by the Contractor shall demonstrate that the completed cable tray systems will comply with the specified requirements. Cable trays shall terminate 10 inches from both sides of smoke and fire partitions. Conductors run through smoke and fire partitions shall be installed in 4 inch rigid steel conduits with grounding bushings, extending 12 inches beyond each side of the partitions. The installation shall be sealed to preserve the smoke and fire rating of the partitions. Penetrations shall be firestopped in accordance with Section 07840A FIRESTOPPING.

#### 3.2.3 Cables and Conductors

Installation shall conform to the requirements of NFPA 70. Covered, bare or insulated conductors of circuits rated over 600 volts shall not occupy the same equipment wiring enclosure, cable, or raceway with conductors of circuits rated 600 volts or less.

##### 3.2.3.1 Sizing

Unless otherwise noted, all sizes are based on copper conductors and the insulation types indicated. Sizes shall be not less than indicated. Branch-circuit conductors shall be not smaller than No. 12 AWG. Conductors for branch circuits of 120 volts more than 100 feet long and of 277 volts more than 230 feet long, from panel to load center, shall be no smaller than No. 10 AWG. Class 1 remote control and signal circuit conductors shall be not less than No. 14 AWG. Class 2 remote control and signal

circuit conductors shall be not less than No. 16 AWG. Class 3 low-energy, remote-control and signal circuits shall be not less than No. 22 AWG.

#### 3.2.3.2 Use of Aluminum Conductors in Lieu of Copper

Aluminum conductors shall not be used.

#### 3.2.3.3 Cable Splicing

Splices shall be made in an accessible location. Crimping tools and dies shall be approved by the connector manufacturer for use with the type of connector and conductor.

- a. Copper Conductors, 600 Volt and Under: Splices in conductors No. 10 AWG and smaller diameter shall be made with an insulated, pressure-type connector. Splices in conductors No. 8 AWG and larger diameter shall be made with a solderless connector and insulated with tape or heat-shrink type insulating material equivalent to the conductor insulation.

#### 3.2.3.4 Conductor Identification and Tagging

Power, control, and signal circuit conductor identification shall be provided within each enclosure where a tap, splice, or termination is made.

Where several feeders pass through a common pull box, the feeders shall be tagged to indicate clearly the electrical characteristics, circuit number, and panel designation. Phase conductors of low voltage power circuits shall be identified by color coding. Phase identification by a particular color shall be maintained continuously for the length of a circuit, including junctions.

- a. Color coding shall be provided for service, feeder, branch, and ground conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in the same raceway or box, other neutral shall be white with colored (not green) stripe. The color coding for 3-phase and single-phase low voltage systems shall be as follows:

120/208-volt, 3-phase: Black(A), red(B), and blue(C).

277/480-volt, 3-phase: Brown(A), orange(B), and yellow(C).

- b. Conductor phase and voltage identification shall be made by color-coded insulation for all conductors smaller than No. 6 AWG. For conductors No. 6 AWG and larger, identification shall be made by color-coded insulation, or conductors with black insulation may be furnished and identified by the use of half-lapped bands of colored electrical tape wrapped around the insulation for a minimum of 3 inches of length near the end, or other method as submitted by the Contractor and approved by the Contracting Officer.
- c. Control and signal circuit conductor identification shall be made by color-coded insulated conductors, plastic-coated self-sticking printed markers, permanently attached stamped metal foil markers, or equivalent means as approved. Control circuit terminals of equipment shall be properly identified. Terminal and conductor identification shall match that shown on approved detail drawings.

Hand lettering or marking is not acceptable.

### 3.3 BOXES AND SUPPORTS

Boxes shall be provided in the wiring or raceway systems where required by NFPA 70 for pulling of wires, making connections, and mounting of devices or fixtures. Pull boxes shall be furnished with screw-fastened covers. Indicated elevations are approximate, except where minimum mounting heights for hazardous areas are required by NFPA 70. Unless otherwise indicated, boxes for wall switches shall be mounted 48 inches above finished floors. Switch and outlet boxes located on opposite sides of fire rated walls shall be separated by a minimum horizontal distance of 24 inches. The total combined area of all box openings in fire rated walls shall not exceed 100 square inches per 100 square feet. Maximum box areas for individual boxes in fire rated walls vary with the manufacturer and shall not exceed the maximum specified for that box in UL Elec Const Dir. Only boxes listed in UL Elec Const Dir shall be used in fire rated walls.

#### 3.3.1 Box Applications

Each box shall have not less than the volume required by NFPA 70 for number of conductors enclosed in box. Boxes for metallic raceways shall be listed for the intended use when located in normally wet locations, when flush or surface mounted on outside of exterior surfaces, or when located in hazardous areas. Boxes installed in wet locations and boxes installed flush with the outside of exterior surfaces shall be gasketed. Boxes for mounting lighting fixtures shall be not less than 4 inches square, or octagonal, except smaller boxes may be installed as required by fixture configuration, as approved. Cast-metal boxes with 3/32 inch wall thickness are acceptable. Large size boxes shall be NEMA 1 or as shown. Boxes in other locations shall be sheet steel except that aluminum boxes may be used with aluminum conduit, and nonmetallic boxes may be used with nonmetallic conduit and tubing or nonmetallic sheathed cable system, when permitted by NFPA 70. Boxes for use in masonry-block or tile walls shall be square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers.

#### 3.3.2 Brackets and Fasteners

Boxes and supports shall be fastened to wood with wood screws or screw-type nails of equal holding strength, with bolts and metal expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screw or welded studs on steel work. Threaded studs driven in by powder charge and provided with lockwashers and nuts, or nail-type nylon anchors may be used in lieu of expansion shields, or machine screws. Penetration of more than 1-1/2 inches into reinforced-concrete beams or more than 3/4 inch into reinforced-concrete joists shall avoid cutting any main reinforcing steel. The use of brackets which depend on gypsum wallboard or plasterboard for primary support will not be permitted. In partitions of light steel construction, bar hangers with 1 inch long studs, mounted between metal wall studs or metal box mounting brackets shall be used to secure boxes to the building structure. When metal box mounting brackets are used, additional box support shall be provided on the side of the box opposite the brackets. This additional box support shall consist of a minimum 12 inch long section of wall stud, bracketed to the opposite side of the box and secured by two screws through the wallboard on each side of the stud. Metal screws may be used in lieu of the metal box mounting brackets.

### 3.3.3 Mounting in Walls, Ceilings, or Recessed Locations

In walls or ceilings of concrete, tile, or other non-combustible material, boxes shall be installed so that the edge of the box is not recessed more than 1/4 inch from the finished surface. Boxes mounted in combustible walls or ceiling material shall be mounted flush with the finished surface. The use of gypsum or plasterboard as a means of supporting boxes will not be permitted. Boxes installed for concealed wiring shall be provided with suitable extension rings or plaster covers, as required. The bottom of boxes installed in masonry-block walls for concealed wiring shall be mounted flush with the top of a block to minimize cutting of the blocks, and boxes shall be located horizontally to avoid cutting webs of block. Separate boxes shall be provided for flush or recessed fixtures when required by the fixture terminal operating temperature, and fixtures shall be readily removable for access to the boxes unless ceiling access panels are provided.

### 3.3.4 Installation in Overhead Spaces

In open overhead spaces, cast-metal boxes threaded to raceways need not be separately supported except where used for fixture support; cast-metal boxes having threadless connectors and sheet metal boxes shall be supported directly from the building structure or by bar hangers. Hangers shall not be fastened to or supported from joist bridging. Where bar hangers are used, the bar shall be attached to raceways on opposite sides of the box and the raceway shall be supported with an approved type fastener not more than 24 inches from the box.

## 3.4 DEVICE PLATES

One-piece type device plates shall be provided for all outlets and fittings. Plates on unfinished walls and on fittings shall be of zinc-coated sheet steel, cast-metal, or impact resistant plastic having rounded or beveled edges. Plates on finished walls shall be of steel with baked enamel finish or impact-resistant plastic and shall be ivory. Screws shall be of metal with countersunk heads, in a color to match the finish of the plate. Plates shall be installed with all four edges in continuous contact with finished wall surfaces without the use of mats or similar devices. Plaster fillings will not be permitted. Plates shall be installed with an alignment tolerance of 1/16 inch. The use of sectional-type device plates will not be permitted. Plates installed in wet locations shall be gasketed and provided with a hinged, gasketed cover, unless otherwise specified.

## 3.5 RECEPTACLES

### 3.5.1 Duplex, 20-ampere, 125 volt

Duplex receptacles shall be rated 20 amperes, 125 volts, two-pole, three-wire, grounding type with polarized parallel slots. Bodies shall be of ivory to match color of switch handles in the same room or to harmonize with the color of the respective wall, and supported by mounting strap having plaster ears. Contact arrangement shall be such that contact is made on two sides of an inserted blade. Receptacle shall be side or back-wired with two screws per terminal. The third grounding pole shall be connected to the metal mounting yoke. Switched receptacles shall be the same as other receptacles specified except that the ungrounded pole of each suitable receptacle shall be provided with a separate terminal. Receptacles with ground fault circuit interrupters shall have the current

rating as indicated, and shall be UL Class A type unless otherwise shown. Ground fault circuit protection shall be provided as required by NFPA 70 and as indicated on the drawings.

### 3.5.2 Floor Outlets

Floor outlets shall be adjustable and each outlet shall consist of a cast-metal body with threaded openings for conduits, adjustable ring, and cover plate with 1/2 inch or 3/4 inch threaded flush plug. Each telephone outlet shall consist of a horizontal cast housing with a receptacle as specified. Gaskets shall be used where necessary to ensure a watertight installation. Plugs with installation instructions shall be delivered to the Contracting Officer at the job site for capping outlets upon removal of service fittings.

### 3.5.3 Weatherproof Applications

Weatherproof receptacles shall be suitable for the environment, damp or wet as applicable, and the housings shall be labeled to identify the allowable use. Receptacles shall be marked in accordance with UL 514A for the type of use indicated; "Damp locations", "Wet Locations", "Wet Location Only When Cover Closed". Assemblies shall be installed in accordance with the manufacturer's recommendations.

#### 3.5.3.1 Damp Locations

Receptacles in damp locations shall be mounted in an outlet box with a gasketed, weatherproof, cast-metal cover plate (device plate, box cover) and a gasketed cap (hood, receptacle cover) over each receptacle opening. The cap shall be either a screw-on type permanently attached to the cover plate by a short length of bead chain or shall be a flap type attached to the cover with a spring loaded hinge.

#### 3.5.3.2 Wet Locations

Receptacles in wet locations shall be installed in an assembly rated for such use whether the plug is inserted or withdrawn, unless otherwise indicated. In a duplex installation, the receptacle cover shall be configured to shield the connections whether one or both receptacles are in use. Assemblies which utilize a self-sealing boot or gasket to maintain wet location rating shall be furnished with a compatible plug at each receptacle location and a sign notifying the user that only plugs intended for use with the sealing boot shall be connected during wet conditions.

### 3.5.4 Receptacles, 20 and 30-Ampere, 125/250-Volt

Receptacles, single, 20 and 30-ampere, 125/250-volt, shall be molded-plastic, three-pole, four-wire, grounding type, complete with appropriate mating cord-grip type attachment plug. Each dryer receptacle shall be furnished with a non-detachable power supply cord for connection to the electric clothes dryer. The cord shall be an angle-type 36 inch length of Type SRD, SRDE or SRDT range and dryer cable with three No. 10 AWG conductors.

### 3.5.5 Receptacles, 50-Ampere, 125/250-Volt

Receptacles, single 50-ampere, 125/250-volt, shall be flush, molded plastic, three-pole, four-wire, grounding type. Each range receptacle shall be furnished with a nondetachable power supply cord for connection to

the electric range. The cord shall be an angle-type 36 inch length of SRD, SRDE or SRDT range and dryer cable with one No. 8 and two No. 6 AWG conductors.

### 3.5.6 Special-Purpose or Heavy-Duty Receptacles

Special-purpose or heavy-duty receptacles shall be of the type and of ratings and number of poles indicated or required for the anticipated purpose. Contact surfaces may be either round or rectangular. One appropriate straight or angle-type plug shall be furnished with each receptacle. Locking type receptacles, rated 30 amperes or less, shall be locked by rotating the plug. Locking type receptacles, rated more than 50 amperes, shall utilize a locking ring.

### 3.6 WALL SWITCHES

Wall switches shall be of the totally enclosed tumbler type. The wall switch handle and switch plate color shall be ivory. Wiring terminals shall be of the screw type or of the solderless pressure type having suitable conductor-release arrangement. Not more than one switch shall be installed in a single-gang position. Switches shall be rated 20-ampere 277-volt for use on alternating current only. Pilot lights indicated shall consist of yoke-mounted candelabra-base sockets rated at 75 watts, 125 volts, and fitted with glass or plastic jewels. A clear 6-watt lamp shall be furnished and installed in each pilot switch. Jewels for use with switches controlling motors shall be green, and jewels for other purposes shall be red. Dimming switches shall be solid-state flush mounted, sized for the loads.

### 3.7 SERVICE EQUIPMENT

Service-disconnecting means shall be of the enclosed molded-case circuit breaker type with an external handle for manual operation. When service disconnecting means is a part of an assembly, the assembly shall be listed as suitable for service entrance equipment. Enclosures shall be sheet metal with hinged cover for surface mounting unless otherwise indicated.

### 3.8 PANELBOARDS

Circuit breakers and switches used as a motor disconnecting means shall be capable of being locked in the open position. Door locks shall be keyed alike. Nameplates shall be as approved. Directories shall be typed to indicate loads served by each circuit and mounted in a holder behind a clear protective covering. Busses shall be copper.

#### 3.8.1 Panelboards

Panelboards shall be circuit breaker equipped as indicated on the drawings.

### 3.9 UNDERGROUND SERVICE

Unless otherwise indicated, interior conduit systems shall be stubbed out 5 feet beyond the building wall and 2 feet below finished grade, for interface with the exterior service lateral conduits and exterior communications conduits. Outside conduit ends shall be bushed when used for direct burial service lateral conductors. Outside conduit ends shall be capped or plugged until connected to exterior conduit systems. Underground service lateral conductors will be extended to building service entrance

and terminated in accordance with the requirements of Section 16375A ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND and NFPA 70.

### 3.10 MOTORS

Each motor shall conform to the hp and voltage ratings indicated, and shall have a service factor and other characteristics that are essential to the proper application and performance of the motors under conditions shown or specified. Three-phase motors for use on 3-phase 208-volt systems shall have a nameplate rating of 200 volts. Unless otherwise specified, all motors shall have open frames, and continuous-duty classification based on a 40 degree C ambient temperature reference. Polyphase motors shall be squirrel-cage type, having normal-starting-torque and low-starting-current characteristics, unless other characteristics are specified in other sections of these specifications or shown on contract drawings. The Contractor shall be responsible for selecting the actual horsepower ratings and other motor requirements necessary for the applications indicated. When electrically driven equipment furnished under other sections of these specifications materially differs from the design, the Contractor shall make the necessary adjustments to the wiring, disconnect devices and branch-circuit protection to accommodate the equipment actually installed.

### 3.11 MOTOR CONTROL

Each motor or group of motors requiring a single control and not controlled from a motor-control center shall be provided under other sections of these specifications with a suitable controller and devices that will perform the functions as specified for the respective motors. Each motor of 1/8 hp or larger shall be provided with thermal-overload protection. Polyphase motors shall have overload protection in each ungrounded conductor. The overload-protection device shall be provided either integral with the motor or controller, or shall be mounted in a separate enclosure. Unless otherwise specified, the protective device shall be of the manually reset type. Single or double pole tumbler switches specifically designed for alternating-current operation only may be used as manual controllers for single-phase motors having a current rating not in excess of 80 percent of the switch rating. Automatic control devices such as thermostats, float or pressure switches may control the starting and stopping of motors directly, provided the devices used are designed for that purpose and have an adequate horsepower rating. When the automatic-control device does not have such a rating, a magnetic starter shall be used, with the automatic-control device actuating the pilot-control circuit. When combination manual and automatic control is specified and the automatic-control device operates the motor directly, a double-throw, three-position tumbler or rotary switch shall be provided for the manual control; when the automatic-control device actuates the pilot control circuit of a magnetic starter, the latter shall be provided with a three-position selector switch marked MANUAL-OFF-AUTOMATIC. Connections to the selector switch shall be such that only the normal automatic regulatory control devices will be bypassed when the switch is in the Manual position; all safety control devices, such as low- or high-pressure cutouts, high-temperature cutouts, and motor-overload protective devices, shall be connected in the motor-control circuit in both the Manual and the Automatic positions of the selector switch. Control circuit connections to any MANUAL-OFF-AUTOMATIC switch or to more than one automatic regulatory control device shall be made in accordance with wiring diagram approved by the Contracting Officer unless such diagram is included on the drawings. All controls shall be 120 volts or less unless otherwise indicated.

### 3.11.1 Motor Control Centers

Control centers shall be indoor type and shall contain combination starters and other equipment as indicated. Control centers shall be NEMA ICS 2, Class I, Type B. Each control center shall be mounted on floor sills or mounting channels. Each circuit shall have a suitable metal or laminated plastic nameplate with white cut letters. Combination starters shall be provided with circuit breakers. Motor control centers shall be provided with a full-length ground bus bar.

### 3.11.2 Contacts

Unless otherwise indicated, contacts in miscellaneous control devices such as float switches, pressure switches, and auxiliary relays shall have current and voltage ratings in accordance with NEMA ICS 2 for rating designation B300.

### 3.11.3 Safety Controls

Safety controls for boilers shall be connected to a 2-wire, 120 volt grounded circuit supplied from the associated boiler-equipment circuit. Where the boiler circuit is more than 120 volts to ground, safety controls shall be energized through a two-winding transformer having its 120 volt secondary winding grounded. Overcurrent protection shall be provided in the ungrounded secondary conductor and shall be sized for the load encountered.

### 3.12 MOTOR-DISCONNECT MEANS

Each motor shall be provided with a disconnecting means when required by NFPA 70 even though not indicated. For single-phase motors, a single or double pole toggle switch, rated only for alternating current, will be acceptable for capacities less than 30 amperes, provided the ampere rating of the switch is at least 125 percent of the motor rating. Switches shall disconnect all ungrounded conductors.

### 3.13 TRANSFORMER INSTALLATION

Three-phase transformers shall be connected only in a delta-wye or wye-delta configuration as indicated. "T" connections may be used for transformers rated at 15 kVA or below. Dry-type transformers shown located within 5 feet of the exterior wall shall be provided in a weatherproof enclosure. Transformers to be located within the building may be provided in the manufacturer's standard, ventilated indoor enclosure designed for use in 40 degrees C ambient temperature, unless otherwise indicated.

### 3.14 LIGHTING FIXTURES, LAMPS AND BALLASTS

This paragraph shall cover the installation of lamps, lighting fixtures and ballasts in interior or building mounted applications.

#### 3.14.1 Lamps

Lamps of the type, wattage, and voltage rating indicated shall be delivered to the project in the original cartons and installed just prior to project completion. Lamps installed and used for working light during construction shall be replaced prior to turnover to the Government if more than 15% of their rated life has been used. Lamps shall be tested for proper operation prior to turn-over and shall be replaced if necessary with new lamps from

the original manufacturer. 10% spare lamps of each type, from the original manufacturer, shall be provided.

### 3.14.2 Lighting Fixtures

Fixtures shall be as shown and shall conform to the following specifications and shall be as detailed on the drawings. Illustrations shown on the drawings are indicative of the general type desired and are not intended to restrict selection to fixtures of any particular manufacturer. Fixtures of similar designs and equivalent energy efficiency, light distribution and brightness characteristics, and of equal finish and quality will be acceptable if approved. In suspended acoustical ceilings with fluorescent fixtures, the fluorescent emergency light fixtures shall be furnished with self-contained battery packs.

#### 3.14.2.1 Accessories

Accessories such as straps, mounting plates, nipples, or brackets shall be provided for proper installation.

#### 3.14.2.2 Ceiling Fixtures

Ceiling fixtures shall be coordinated with and suitable for installation in, on or from the ceiling as shown. Installation and support of fixtures shall be in accordance with NFPA 70 and manufacturer's recommendations. Where seismic requirements are specified herein, fixtures shall be supported as shown or specified. Recessed fixtures shall have adjustable fittings to permit alignment with ceiling panels. Recessed fixtures installed in fire-resistive ceiling construction shall have the same fire rating as the ceiling or shall be provided with fireproofing boxes having materials of the same fire rating as the ceiling, in conformance with UL Elec Const Dir. Surface-mounted fixtures shall be suitable for fastening to the ceiling panel structural supports.

#### 3.14.2.3 Fixtures for Installation in Grid Type Ceilings

Fixtures for installation in grid type ceilings which are smaller than a full tile shall be centered in the tile. 1 by 4 foot fixtures shall be mounted along the grid rail as shown. Work above the ceiling shall be coordinated among the trades to provide the lighting layout shown. Fixtures mounted to the grid shall have trim exactly compatible with the grid. Contractor shall coordinate trims with ceiling trades prior to ordering fixtures. Metric fixtures shall be designed to fit the metric grid specified. Fixtures in continuous rows shall be coordinated between trades prior to ordering. Fixtures shall be mounted using independent supports capable of supporting the entire weight of the fixture. No fixture shall rest solely on the ceiling grid. Recessed fixtures installed in seismic areas should be installed utilizing specially designed seismic clips. Junction boxes shall be supported at four points.

#### 3.14.2.4 Suspended Fixtures

Suspended fixtures shall be provided with swivel hangers or hand-straightens so that they hang plumb. Pendants, rods, or chains 4 feet or longer excluding fixture shall be braced to prevent swaying using three cables at 120 degrees of separation. Suspended fixtures in continuous rows shall have internal wireway systems for end to end wiring and shall be properly aligned to provide a straight and continuous row without bends, gaps, light leaks or filler pieces. Aligning splines shall be used on extruded

aluminum fixtures to assure hairline joints. Steel fixtures shall be supported to prevent "oil-canning" effects. Fixture finishes shall be free of scratches, nicks, dents, and warps, and shall match the color and gloss specified. Pendants shall be finished to match fixtures. Aircraft cable shall be stainless steel. Canopies shall be finished to match the ceiling and shall be low profile unless otherwise shown. Maximum distance between suspension points shall be 10 feet or as recommended by the manufacturer, whichever is less.

Suspended fixtures installed in seismic areas shall have 45% swivel hangers and shall be located with no obstructions within the 45% range in all directions. The stem, canopy and fixture shall be capable of 45% swing.

#### 3.14.3 Ballasts

Remote type ballasts or transformers, where indicated, shall be mounted in a well ventilated, easily accessible location, within the maximum operating distance from the lamp as designated by the manufacturer.

#### 3.14.4 Emergency Light Sets

Emergency light sets shall conform to UL 924 with the number of heads as indicated. Sets shall be permanently connected to the wiring system by conductors installed in short lengths of flexible conduit.

### 3.15 EQUIPMENT CONNECTIONS

Wiring not furnished and installed under other sections of the specifications for the connection of electrical equipment as indicated on the drawings shall be furnished and installed under this section of the specifications. Connections shall comply with the applicable requirements of paragraph WIRING METHODS. Flexible conduits 6 feet or less in length shall be provided to all electrical equipment subject to periodic removal, vibration, or movement and for all motors. All motors shall be provided with separate grounding conductors. Liquid-tight conduits shall be used in damp or wet locations.

#### 3.15.1 Motors and Motor Control

Motors, motor controls, and motor control centers shall be installed in accordance with NFPA 70, the manufacturer's recommendations, and as indicated. Wiring shall be extended to motors, motor controls, and motor control centers and terminated.

#### 3.15.2 Installation of Government-Furnished Equipment

Wiring shall be extended to the equipment and terminated.

### 3.16 CIRCUIT PROTECTIVE DEVICES

The Contractor shall calibrate, adjust, set and test each new adjustable circuit protective device to ensure that they will function properly prior to the initial energization of the new power system under actual operating conditions.

### 3.17 PAINTING AND FINISHING

Field-applied paint on exposed surfaces shall be provided under Section 09900 PAINTS AND COATINGS.

### 3.18 REPAIR OF EXISTING WORK

The work shall be carefully laid out in advance, and where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceiling, or other surfaces is necessary for the proper installation, support, or anchorage of the conduit, raceways, or other electrical work, this work shall be carefully done, and any damage to building, piping, or equipment shall be repaired by skilled mechanics of the trades involved at no additional cost to the Government.

### 3.19 FIELD TESTING

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 20 days prior to conducting tests. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform all tests and inspection recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. All field test reports will be signed and dated by the Contractor.

#### 3.19.1 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

#### 3.19.2 Ground-Resistance Tests

The resistance of each grounding electrode shall be measured using the fall-of-potential method defined in IEEE Std 81. Soil resistivity in the area of the grid shall be measured concurrently with the grid measurements.

Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

- a. Single rod electrode - 25 ohms.

#### 3.19.3 Cable Tests

The Contractor shall be responsible for identifying all equipment and devices that could be damaged by application of the test voltage and ensuring that they have been properly disconnected prior to performing insulation resistance testing. An insulation resistance test shall be performed on all low and medium voltage cables after the cables are installed in their final configuration and prior to energization. The test voltage shall be 500 volts DC applied for one minute between each conductor and ground and between all possible combinations of conductors. The minimum value of resistance shall be:

$R$  in megohms = (rated voltage in kV + 1) x 1000/(length of cable in feet)

Each cable failing this test shall be repaired or replaced. The repaired cable system shall then be retested until failures have been eliminated.

#### 3.19.3.1 Low Voltage Cable Tests

- a. Continuity test.
- b. Insulation resistance test.

#### 3.19.4 Motor Tests

- a. Phase rotation test to ensure proper directions.

### 3.20 OPERATING TESTS

After the installation is completed, and at such time as the Contracting Officer may direct, the Contractor shall conduct operating tests for approval. The equipment shall be demonstrated to operate in accordance with the specified requirements. An operating test report shall be submitted in accordance with paragraph FIELD TEST REPORTS.

### 3.21 FIELD SERVICE

#### 3.21.1 Onsite Training

The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 2 training days for 8 hours per day of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. The course instruction shall cover pertinent points involved in operating, starting, stopping, servicing the equipment, as well as all major elements of the operation and maintenance manuals. Additionally, the course instructions shall demonstrate all routine maintenance operations. A VHS format video tape of the entire training shall be submitted.

#### 3.21.2 Installation Engineer

After delivery of the equipment, the Contractor shall furnish one or more field engineers, regularly employed by the equipment manufacturer to supervise the installation of equipment, assist in the performance of the onsite tests, oversee initial operations, and instruct personnel as to the operational and maintenance features of the equipment.

### 3.22 ACCEPTANCE

Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected.

-- End of Section --

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## SECTION 16528A

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05/01

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## SECTION 16528A

EXTERIOR LIGHTING  
05/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO LTS-3 (1994) Standard Specifications for  
Structural Supports for Highway Signs,  
Luminaires and Traffic Signals

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C78.1375 (1996) 400-Watt, M59 Single-Ended  
Metal-Halide Lamps

ANSI C78.1376 (1996) 1000-Watt, M47 Metal-Halide Lamps

ANSI C80.1 (1995) Rigid Steel Conduit - Zinc Coated

ANSI C82.4 (1992) Ballasts for  
High-Intensity-Discharge and Low-Pressure  
Sodium Lamps (Multiple-Supply Type)

ANSI C119.1 (1986; R 1997) Sealed Insulated  
Underground Connector Systems Rated 600  
Volts

ANSI C135.1 (1979) Galvanized Steel Bolts and Nuts for  
Overhead Line Construction

ANSI C135.14 (1979) Staples with Rolled or Slash Points  
for Overhead Line Construction

ANSI C136.2 (1996) Luminaires, Voltage Classification  
of Roadway Lighting Equipment

ANSI C136.3 (1995) Roadway Lighting  
Equipment-Luminaire Attachments

ANSI C136.6 (1997) Roadway Lighting Equipment - Metal  
Heads and Reflector Assemblies -  
Mechanical and Optical Interchangeability

ANSI C136.9 (1990) Roadway Lighting - Socket Support  
Assemblies for Use in Metal Heads -  
Mechanical Interchangeability

- ANSI C136.10 (1996) Roadway Lighting- Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing
- ANSI C136.11 (1995) Multiple Sockets for Roadway Lighting Equipment
- ANSI C136.15 (1997) Roadway Lighting, High Intensity Discharge and Low Pressure Sodium Lamps in Luminaires -

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM A 123/A 123M (2000) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- ASTM A 153/A 153M (2000) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- ASTM A 575 (1996) Steel Bars, Carbon, Merchant Quality, M-Grades
- ASTM A 576 (1990b; R 1995e1) Steel Bars, Carbon, Hot-Wrought, Special Quality
- ASTM B 117 (1997) Operating Salt Spray (Fog) Apparatus
- ASTM D 1654 (1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

## ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA)

- IESNA RP-8 (1983; R 1993) Roadway Lighting

## INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

- IEEE C2 (1997) National Electrical Safety Code
- IEEE C136.13 (1987; R 1997) Metal Brackets for Wood Poles
- IEEE Std 81 (1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- NEMA ICS 1 (1993) Industrial Control and Systems
- NEMA ICS 2 (1993) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated Not More Than 2,000 Volts AC or 750 Volts DC

NEMA ICS 6	(1993) Industrial Control and Systems, Enclosures
NEMA OS 1	(1996) Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports
NEMA OS 2	(1998) Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports
NEMA RN 1	(1998) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2002) National Electrical Code
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## UNDERWRITERS LABORATORIES (UL)

UL 6	(1997) Rigid Metal Conduit
UL 44	(1999) Thermoset-Insulated Wires and Cables
UL 98	(1994; Rev thru Jun 1998) Enclosed and Dead-Front Switches
UL 467	(1993; Rev thru Apr 1999) Grounding and Bonding Equipment
UL 486A	(1997; Rev thru Dec 1998) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 514A	(1996; Rev Dec 1999) Metallic Outlet Boxes
UL 514B	(1996; Rev Oct 1998) Fittings for Conduit and Outlet Boxes
UL 514C	(1996; Rev thru Dec 1999) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 651	(1995; Rev thru Oct 1998) Schedule 40 and 80 Rigid PVC Conduit
UL 651A	(1995; Rev thru Apr 1998) Type EB and A Rigid PVC Conduit and HDPE Conduit
UL 854	(1996; Rev Oct 1999) Service-Entrance Cables
UL 1029	(1994; Rev thru Dec 1997) High-Intensity-Discharge Lamp Ballasts
UL 1572	(1995; Rev thru Nov 1999) High Intensity Discharge Lighting Fixtures

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Lighting System; G-AO  
Detail Drawings; G-AO

Detail drawings for the complete system and for poles, lighting fixtures and bracket arms.

SD-03 Product Data

Equipment and Materials; G-AO

Data published by the manufacturer of each item on the list of equipment and material, to permit verification that the item proposed is of the correct size, properly rated or applied, or is otherwise suitable for the application and fully conforms to the requirements specified.

Spare Parts; G-AO

Spare parts data for each item of material and equipment specified, after approval of detail drawings for materials and equipment, and not later than 4 months before the date of beneficial occupancy. The data shall include a complete list of parts, special tools, and supplies, with current unit prices and sources of supply.

Operating Test; G-AO

Test procedures and reports for the Operating Test. After receipt by the Contractor of written approval of the test procedures, the Contractor shall schedule the tests. The final test procedures report shall be delivered after completion of the tests.

Ground Resistance Measurements; G-AO

The measured resistance to ground of each separate grounding installation, indicating the location of the rods, the resistance of the soil in ohms per millimeter and the soil conditions at the time the measurements were made. The information shall be in writing.

SD-10 Operation and Maintenance Data

Lighting System; G-AO

A draft copy of the operation and maintenance manuals, prior to beginning the tests for use during site testing. Final copies of the manuals as specified bound in hardback, loose-leaf binders, within 30 days after completing the field test. The draft copy used during site testing shall be updated with any changes

required, prior to final delivery of the manuals. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of each subcontractor installing equipment and systems, and nearest service representatives for each item of equipment for each system. The manuals shall have a table of contents and tab sheets. Tab sheets shall be placed at the beginning of each chapter or section and at the beginning of each appendix. The final copies delivered after completion of the field test shall include modifications made during installation checkout and acceptance.

### 1.3 SYSTEM DESCRIPTION

#### 1.3.1 Lighting System

The lighting system shall be configured as specified and shown. The system shall include all fixtures, hardware, poles, cables, connectors, adapters and appurtenances needed to provide a fully functional lighting system.

#### 1.3.2 Electrical Requirements

The equipment shall operate from a voltage source as shown, plus or minus 10 percent, and 60 Hz, plus or minus 2 percent.

#### 1.3.3 Nameplates

Each major component of equipment shall have a nonferrous metal or engraved plastic nameplate which shall show, as a minimum, the manufacturer's name and address, the catalog or style number, the electrical rating in volts, and the capacity in amperes or watts.

#### 1.3.4 Standard Products

Materials and equipment shall be standard products of manufacturer regularly engaged in the manufacture of such products. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening.

### 1.4 CORROSION PROTECTION

#### 1.4.1 Aluminum Materials

Aluminum shall not be used.

#### 1.4.2 Ferrous Metal Materials

##### 1.4.2.1 Hardware

Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A 153/A 153M and ASTM A 123/A 123M.

##### 1.4.2.2 Equipment

Equipment and component items, including but not limited to metal poles and ferrous metal luminaires not hot-dip galvanized or porcelain enamel finished, shall be provided with corrosion-resistant finishes which shall withstand 120 hours of exposure to the salt spray test specified in ASTM B 117 without loss of paint or release of adhesion of the paint primer coat

to the metal surface in excess of 1/16 inch from the test mark. The scribed test mark and test evaluation shall have a rating of not less than 7 in accordance with TABLE 1, (procedure A) of ASTM D 1654. Cut edges or otherwise damaged surfaces of hot-dip galvanized sheet steel or mill galvanized sheet steel shall be coated with a zinc rich paint conforming to the manufacturer's standard.

#### 1.4.3 Finishing

Painting required for surfaces not otherwise specified and finish painting of items only primed at the factory, shall be as specified in Section 09900 PAINTING, GENERAL.

### PART 2 PRODUCTS

#### 2.1 STANDARD PRODUCT

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

#### 2.2 BRACKET ARMS

##### 2.2.1 On Aluminum or Steel Poles

Poles shall be provided with bracket arms of the support arm style and of the length indicated on drawings. Bracket arms shall conform to the design of the pole provided. The bracket arms shall be capable of supporting the equipment to be mounted on it with the maximum wind and ice loading encountered at the site. Strength of bracket arms shall be in accordance with IEEE C136.13. Steel brackets shall be galvanized. Wood bracket arms shall not be used.

#### 2.3 CABLE

The Contractor shall provide all wire and cable not indicated as government furnished equipment. Wire and cable components shall be able to withstand the jobsite environment for a minimum of 20 years.

##### 2.3.1 Insulated Cable

Cable shall be type USE conforming to UL 854, with copper conductors and type RHW or XHHW insulation conforming to UL 44, and shall include green ground conductor. Cable shall be rated 600 volts. Parts of the cable system such as splices and terminations shall be rated not less than 600 volts. The size and number of conductors and the number of cables shall be as indicated. Conductors larger than No. 8 AWG shall be stranded.

#### 2.4 CABLE SPLICES AND CONNECTORS

Cable splices and connectors shall conform to UL 486A. Underground splices and connectors shall also conform to the requirements of ANSI C119.1.

#### 2.5 CONDUIT, DUCTS AND FITTINGS

##### 2.5.1 Conduit, Rigid Steel

Rigid steel conduit shall conform to ANSI C80.1 and UL 6.

#### 2.5.2 Conduit Coatings

Underground metallic conduit and fittings shall be coated with a plastic resin system conforming to NEMA RN 1, Type 40. Epoxy systems may also be used.

#### 2.5.3 Conduit Fittings and Outlets

##### 2.5.3.1 Boxes, Metallic Outlets

NEMA OS 1 and UL 514A.

##### 2.5.3.2 Boxes, Nonmetallic, Outlet and Flush-Device Boxes and Covers

NEMA OS 2 and UL 514C.

##### 2.5.3.3 Boxes, Switch (Enclosed), Surface Mounted

UL 98.

##### 2.5.3.4 Fittings for Conduit and Outlet Boxes

UL 514B.

##### 2.5.3.5 Fittings, PVC, for Use with Rigid PVC Conduit and Tubing

UL 514B.

#### 2.5.4 Non-Metallic Duct

Non-metallic duct lines and fittings utilized for underground installation shall be suitable for the application. Duct shall be thick-wall, single, round-bore type. Material of one type shall be used. High-density conduit shall conform to UL 651A. Schedule 40 polyvinyl chloride (PVC) shall conform to UL 651. Plastic utility duct and fittings manufactured without a UL label or listing shall be provided with a certification as follows: "The materials are suitable for use with 167 degree F wiring. No reduction of properties in excess of that specified for materials with a UL label or listing will be experienced if samples of the finished product are operated continuously under the normal conditions that produce the highest temperature in the duct."

#### 2.6 GROUND RODS

Ground rods shall be of copper clad steel conforming to UL 467 not less than 3/4 inch in diameter by 10 feet in length of the sectional type driven full length into earth.

#### 2.7 POLES

Metal poles shall be the pole manufacturer's standard design for supporting the number of fixtures indicated. Contractor may provide aluminum poles or steel poles. Poles shall be designed for a wind velocity of 100 mph at the base of the pole, for a wind gust factor of 1.3, and for the height and drag factors recommended by AASHTO LTS-3. The effective projected area of luminaires and other pole-mounted devices shall be taken into account in pole design. Poles shall have grounding provisions. The type of pole

shaft material provided shall not be mixed on any project. Grounding connection shall be provided near the bottom of each metal pole and at each concrete pole anchor base. Scratched, stained, chipped, or dented poles shall not be installed.

#### 2.7.1 Aluminum Poles

Aluminum poles and brackets for parking lot lighting shall have a dark anodic bronze finish to match fixtures and shall not be painted. Manufacturer's standard provision shall be made for protecting the finish during shipment and installation. Minimum protection shall consist of spirally wrapping each pole shaft with protective paper secured with tape, and shipping small parts in boxes.

- a. Shafts shall be round and of seamless construction. The wall thickness shall be at least 0.188 inch. Exterior surfaces shall be free of protuberances, dents, cracks, and discoloration. Material for shafts shall be 6063 aluminum alloy; after fabrication, the alloy shall have a T6 temper. Tops of shafts shall be fitted with a round or tapered cover. Bases shall be anchor bolt mounted, made of cast aluminum alloy 356-T6, and shall be machined to receive the lower end of shafts. Joints between shafts and bases shall be welded. Bases shall be provided with four holes, spaced 90 degrees apart, for anchorage.
- b. Hardware, except anchor bolts, shall be either 2024-T4 anodized aluminum alloy or stainless steel.

#### 2.7.2 Steel Poles

Steel poles shall be hot-dip galvanized in accordance with ASTM A 123/A 123M and shall not be painted. Poles shall have tapered tubular members, either round in cross-section or polygonal. Pole shafts shall be one piece. Poles shall be welded construction with no bolts, rivets, or other means of fastening except as specifically approved. Pole markings shall be approximately 3 to 4 feet above grade and shall include manufacturer, year of manufacture, top and bottom diameters, length, and a loading tree. Attachment requirements shall be provided as indicated, including grounding provisions. Climbing facilities are not required. Bases shall be of the anchor bolt-mounted type.

#### 2.7.3 Anchor Bolts

Anchor bolts shall be the pole manufacturer's standard, but not less than necessary to meet the pole wind and ice loading, herein and other specified design requirements.

#### 2.8 POLE LINE HARDWARE

Zinc coated hardware shall conform to ANSI C135.1 and ANSI C135.14, and steel hardware material shall conform to ASTM A 575 and ASTM A 576. Hardware shall be hot-dip galvanized in accordance with ASTM A 153/A 153M.

#### 2.9 ILLUMINATION

##### 2.9.1 General Lighting

Luminaires, ballasts, lamps, and control devices required for parking lot lighting shall be in accordance with standard details shown on the

drawings.

## 2.10 LAMPS AND BALLASTS, HIGH INTENSITY DISCHARGE (HID) SOURCES

### 2.10.1 Metal-Halide

Lamps shall be made by a manufacturer with not less than 5 years experience in making metal-halide lamps. Metal-halide lamps shall conform to ANSI C78.1375 or ANSI C78.1376. Ballasts shall conform to ANSI C82.4 or UL 1029.

## 2.11 LUMINAIRE COMPONENTS

Luminaire components shall conform to the following: attachments, ANSI C136.3; voltage classification, ANSI C136.2; field identification marking, ANSI C136.15; interchangeability, ANSI C136.6 and ANSI C136.9; and sockets, ANSI C136.11.

## 2.12 LIGHTING CONTROL EQUIPMENT

### 2.12.1 Photo-Control Devices

Photo-control devices shall conform to ANSI C136.10. Each photo-control element shall be a replaceable, weatherproof, plug-in or twist-lock assembly adjustable operation range of approximately 0.5 to 5.0 foot-candles.

### 2.12.2 Timer Control Switches

Astronomic dial type arranged to turn "ON" at sunset, and turn "OFF" at a pre-determined time between 2030 hours hours and 0230 hours or sunrise, automatically changing the settings each day in accordance with seasonal changes of sunset and sunrise shall be provided. A switch rated 120 volts, having automatically wound spring mechanism to maintain accurate time for a minimum of 7 hours following a power failure shall be provided. A time switch with a manual on-off bypass switch shall be provided. Housing for the time switch shall be a surface mounted, NEMA 1 (indoor) enclosure conforming to NEMA ICS 6.

### 2.12.3 Manual Control Switches

Manual control switches shall conform to UL 98. The switches shall be the heavy-duty type and shall be suitable for operation on a 120 volt, 60 Hz system. The number of poles and ampere rating shall be as indicated. Switch construction shall be such that a screwdriver will be required to open the switch door when the switch is on. The selector switch shall have a minimum of three positions: ON, OFF, and AUTOMATIC. The automatic selection shall be used when photoelectric or timer control is desired. The selector switch shall interface with the lighting system magnetic contactor and control its activity.

### 2.12.4 Safety Switches

Switches shall be the heavy-duty type with NEMA ICS 6 Type 1 enclosures and shall be suitable for operation on a 480Y/277 volt, 60 Hz, three-phase system. Switch construction shall be such that a screwdriver will be required to open the switch door when the switch is on. Blades shall be visible with door open and shall be of the quick-make, quick-break type. Terminal lugs shall be coordinated with the wire size. Switches shall conform to UL 98.

### 2.12.5 Magnetic Contactor

Magnetic contactors shall be mechanically held, electrically operated, and shall conform to NEMA ICS 1 and NEMA ICS 2. The contactor shall be suitable for 480volts, 3 phase, 60 Hz. Coil voltage shall be 120 volts. Maximum continuous ampere rating and number of poles shall be as indicated on drawings. Enclosures for contactors mounted indoors shall be NEMA ICS 6, Type 1. Each contactor shall be provided with a spare, normally open auxiliary contact. Terminal lugs shall be coordinated with the wire size.

### 2.13 PHOTOMETRIC DISTRIBUTION CLASSIFICATION

Photometrics shall conform to IESNA RP-8.

### 2.14 LUMINAIRES, FLOODLIGHTING

#### 2.14.1 HID

HID lighting fixtures shall conform to UL 1572.

### 2.15 FIXTURES

Standard fixtures shall be as detailed on the drawings. Illustrations shown on the drawings are indicative of the general type desired and are not intended to restrict selection to fixtures of any particular manufacturer. Fixtures of similar design, equivalent light distribution and brightness characteristics, equal finish and quality will be acceptable as approved.

#### 2.15.1 Accessories

Accessories such as straps, mounting plates, nipples, or brackets shall be provided for proper installation.

#### 2.15.2 In-Line Fuse

An in-line fuse shall be provided for each fixture, and shall consist of a fuse and a UL approved waterproof fuse holder rated at 30 amperes, 600 volts with insulated boots. Fuse rating shall be 600 volts.

## PART 3 EXECUTION

### 3.1 GENERAL

The Contractor shall install all system components, including government furnished equipment, and appurtenances in accordance with the manufacturer's instructions, IEEE C2, and contract documents, and shall furnish necessary hardware, fixtures, cables, wire, connectors, interconnections, services, and adjustments required for a complete and operable system.

#### 3.1.1 Current Site Conditions

The Contractor shall verify that site conditions are in agreement with the design package. The Contractor shall report all changes to the site or conditions that will affect performance of the system to the Government. The Contractor shall not take any corrective action without written permission from the Government.

## 3.2 PREVENTION OF CORROSION

### 3.2.1 Aluminum

Aluminum shall not be used in contact with earth or concrete, and where connected to dissimilar metal, shall be protected by approved fittings and treatment.

### 3.2.2 Steel Conduits

Steel conduits shall not be installed within concrete slabs-on-grade. Steel conduits installed underground or under slabs-on-grade, or penetrating slabs-on-grade, shall be field wrapped with 0.010 inch thick pipe-wrapping plastic tape applied with a 50 percent overlap, or shall have a factory-applied plastic resin, epoxy coating. Zinc coating may be omitted from steel conduit which has a factory-applied epoxy coating.

### 3.2.3 Cold Galvanizing

Field welds and/or brazing on factory galvanized boxes, enclosures, conduits, etc. shall be coated with a cold galvanized paint containing at least 95 percent zinc by weight.

## 3.3 CABLE INSTALLATION

Cable and all parts of the cable system such as splices and terminations shall be rated not less than 600 volts. The size and number of conductors and the number of cables shall be as indicated. Conductors larger than No. 8 AWG shall be stranded. Each circuit shall be identified by means of fiber or nonferrous metal tags, or approved equal, in each pole handhole and at each terminal.

### 3.3.1 Splices

Splices below grade shall be made with nonpressure-filled resin systems using transparent, interlocking, self-venting, longitudinally split plastic molds. Splices above grade shall be made with sealed insulated pressure connectors and shall provide insulation and jacket equal to that of the cable. In order to prevent moisture from entering the splice, jackets shall be cut back to expose the required length of insulation between the jacket and the tapered end of the insulation.

### 3.3.2 Installation in Duct Lines

Ground and neutral conductors shall be installed in duct with the associated phase conductors. Cable splices shall be made in pole handholes only.

## 3.4 CONNECTIONS TO BUILDINGS

Cables shall be extended into the various buildings as indicated and shall be properly connected to the indicated equipment. After installation of cables, conduits shall be sealed to prevent moisture or gases from entering the building.

## 3.5 DUCT LINES

### 3.5.1 Requirements

Numbers and size of ducts shall be as indicated. Duct lines shall be laid with a minimum slope of 4 inches per 100 feet. Depending on the contour of the finished grade, the high point may be at a terminal or pole handholes. Short radius manufactured 90 degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable. The minimum manufactured bend radius shall be 18 inches for ducts of less than 3 inches in diameter, and 36 inches for duct 3 inches or greater in diameter. Otherwise, long sweep bends having a minimum radius of 25 feet shall be used for a change of direction of more than 5 degrees, either horizontally or vertically. Both curved and straight sections may be used to form long sweep bends, but the maximum curve used shall be 30 degrees and manufactured bends shall be used. Ducts shall be provided with end bells when duct lines terminate in manholes or handholes.

### 3.5.2 Treatment

Ducts shall be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and shall match factory tapers. A coupling recommended by the duct manufacturer shall be used when an existing duct is connected to a duct of different material or shape. Ducts shall be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.

### 3.5.3 Nonencased Direct-Burial

Top of duct lines shall be 24 inches, inches below finished grade and shall be installed with a minimum of 3 inches of earth around each duct, except that between adjacent electric power and communication ducts, 12 inches of earth is required. Bottom of trenches shall be graded toward pole handholes and shall be smooth and free of stones, soft spots, and sharp objects. Where bottoms of trenches comprise materials other than sand, a 3 inch layer of sand shall be laid first and compacted to approximate densities of surrounding firm soil before installing ducts. Joints in adjacent tiers of duct shall be vertically staggered at least 6 inches. The first 6 inch layer of backfill cover shall be sand compacted as previously specified. The rest of the excavation shall be backfilled and compacted in 3 to 6 inch layers. Duct banks may be held in alignment with earth. However, high tiered banks shall use a wooden frame or equivalent form to hold ducts in alignment prior to backfilling.

### 3.5.4 Installation of Couplings

Joints in each type of duct shall be made up in accordance with the manufacturer's recommendation for the particular type of duct and coupling selected and as approved.

#### 3.5.4.1 Plastic Duct

Duct joints shall be made by brushing a plastic solvent on insides of plastic coupling fittings and on outsides of duct ends. Each duct and fitting shall then be slipped together with a quick 1/4 turn to set the joint tightly.

#### 3.5.5 Concrete

Concrete work shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Concrete shall be plain, 2500 psi at 28 days, except that reinforced concrete shall be 3000 psi at 28 days.

### 3.6 POLE INSTALLATION

Pole lengths shall provide a luminaire mounting height of 40 feet. Pole installation shall conform to the manufacturer's recommendations, NFPA 70, and IEEE C2. Poles shall be set straight and plumb.

#### 3.6.1 Pole Brackets

Brackets shall be installed as specified by the manufacturer and as shown on drawings. Mounting hardware shall be sized appropriately to secure the mount, luminaire, and housing with wind and ice loading normally encountered at the site. Identical brackets shall be used with one type of luminaire.

#### 3.6.2 Concrete Foundations

Concrete foundations shall have anchor bolts accurately set in the foundation using a template supplied by the pole manufacturer. Once the concrete has cured, the pole shall be set on the foundation, leveled on the foundation bolts, and secured with the holding nuts. The space between the foundation and the pole base shall be grouted. Concrete and grout work shall conform to Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Concrete shall be 3000 psi at 28 days.

#### 3.6.3 Rigid Steel Conduit Ells

Rigid steel conduit ells shall be provided at all poles where specified or indicated on drawings.

#### 3.6.4 Aluminum or Steel Pole Installation

Poles shall be mounted on cast-in-place foundations. Concrete poles shall be embedded in accordance with the details shown. Conduit elbows shall be provided for cable entrances into pole interiors.

##### 3.6.4.1 Cast-In-Place Foundations

Concrete foundations, sized as indicated, shall have anchor bolts accurately set in foundations using templates supplied by the pole manufacturer. Concrete work and grouting is specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. After the concrete has cured, pole anchor bases shall be set on foundations and leveled by shimming between anchor bases and foundations or by setting anchor bases on leveling nuts and grouting. Poles shall be set plumb. Anchor bolts shall be the manufacturer's standard, and not less than necessary to meet the pole wind loading and other specified design requirements.

### 3.7 LIGHTING

#### 3.7.1 Lamps

Lamps of the proper type, wattage, and voltage rating shall be delivered to the project in the original containers and installed in the fixtures just before completion of the project.

### 3.7.2 Fixture Installation

Standard fixtures shall be installed as detailed on the drawings. Illustrations shown on the drawings are indicative of the general type desired and are not intended to restrict selection of fixtures to any particular manufacturer. Fixtures of similar design, equivalent light-distribution and brightness characteristics, and equal finish and quality will be acceptable as approved.

#### 3.7.2.1 Accessories

Accessories such as straps, mounting plates, nipples, or brackets shall be installed as required for proper installation.

#### 3.7.2.2 In-Line Fuses

An in-line fuse shall be provided for each fixture.

### 3.8 LIGHTING CONTROL SYSTEM

#### 3.8.1 Photo-Control

Lighting luminaires shall be controlled by a single photo-control element mounted within lighting contactor.

#### 3.8.2 Time Control Switches

Switches shall be installed with not less than four 1/4 inch bolts. The use of sheet metal screws will not be allowed.

#### 3.8.3 Manual and Safety Switches

Terminal lugs shall be coordinated with the wire size. Switches shall be securely fastened to the supporting structure or wall using not less than four 1/4 inch bolts. The use of sheet metal screws will not be allowed.

#### 3.8.4 Magnetic Contactors

Terminal lugs shall be coordinated with the wire size. Switches shall be securely fastened to the supporting structure or wall using not less than four 1/4 inch bolts. The use of sheet metal screws will not be allowed.

### 3.9 GROUNDING

Grounding shall be in conformance with NFPA 70, the contract drawings, and the following. Grounding conductors shall be soft-drawn, stranded copper. Ground rods shall be driven into the earth so that after the installation is complete, the top of the ground rod will be approximately 1 foot below finished grade, except in handholes. Butt grounds shall not be used.

#### 3.9.1 Ground Rods Electrodes

The resistance to ground shall be measured using the fall-of-potential method described in IEEE Std 81. The maximum resistance of a driven ground rod shall not exceed 25 ohms under normally dry conditions. Whenever the required ground resistance is not met, additional electrodes shall be provided to achieve the specified ground resistance. The additional electrodes shall be up to three, 10 feet long rods spaced a minimum of 10 feet apart. In high ground resistance, UL listed chemically charged ground

rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately. Connections below grade shall be fusion welded. Connections above grade shall be fusion welded or shall use UL 467 approved connectors.

### 3.9.2 Items to be Grounded

Ground conductors, metallic conduits, junction boxes, and noncurrent-carrying metallic parts of equipment shall be grounded. Connections above grade shall be made with solderless connectors, and those below grade shall be made by a fusion-welding process.

### 3.9.3 Lighting Pole

One ground rod shall be provided at each pole. Bases of metal or concrete lighting poles shall be connected to ground rods by means of No. 8 AWG bare copper wire. Lighting fixture brackets on wood and concrete poles shall be grounded to a No. 6 AWG bare copper grounding conductor connected to the ground rod.

## 3.10 TESTS

### 3.10.1 Operating Test

After the installation is completed and at such time as the Contracting Officer may direct, the Contractor shall conduct an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements specified. The test shall be performed in the presence of the Contracting Officer. The Contractor shall furnish instruments and personnel required for the test, and the Government will furnish the necessary electric power.

### 3.10.2 Ground Resistance Measurements

The resistance to ground shall be measured by the fall-of-potential method described in IEEE Std 81.

-- End of Section --

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## SECTION 16710A

## PREMISES DISTRIBUTION SYSTEM

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## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## ELECTRONIC INDUSTRIES ALLIANCE (EIA)

EIA ANSI/TIA/EIA-568-B	(2001) Commercial Building Telecommunications Cabling Standard
EIA ANSI/TIA/EIA-568-B.2-1	(2002) Transmission Performance Specifications for 4-pair 100 ohm Category 6 Cabling
EIA ANSI/TIA/EIA-569-A	(2001) Commercial Building Standard for Telecommunications Pathways and Spaces
EIA ANSI/TIA/EIA-606	(1993) Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
EIA ANSI/TIA/EIA-607	(1994) Commercial Building Grounding/Bonding Requirement Standard
EIA TIA/EIA-TSB-67	(1995) Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2002) National Electrical Code
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## 1.2 SYSTEM DESCRIPTION

The premises distribution system shall consist of inside-plant horizontal, riser, and backbone cables and connecting hardware to transport telephone and data (including LAN) signals between equipment items in a building.

## 1.3 ENVIRONMENTAL REQUIREMENTS

Connecting hardware shall be rated for operation under ambient conditions of 32 to 140 degrees F and in the range of 0 to 95 percent relative humidity, noncondensing.

## 1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation;

submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

##### Premises Distribution System; G-DO

Detail drawings including a complete list of equipment and material. Detail drawings shall contain complete wiring and schematic diagrams and other details required to demonstrate that the system has been coordinated and will function properly as a system. Drawings shall include vertical riser diagrams, equipment rack details, elevation drawings of telecommunications closet walls, outlet face plate details for all outlet configurations, sizes and types of all cables, conduits, and cable trays. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operation.

##### Installation; G-AO

Record drawings for the installed wiring system infrastructure per EIA ANSI/TIA/EIA-606. The drawings shall show the location of all cable terminations and location and routing of all backbone and horizontal cables. The identifier for each termination and cable shall appear on the drawings.

#### SD-03 Product Data

##### Record Keeping and Documentation; G-AO

Documentation on cables and termination hardware in accordance with EIA ANSI/TIA/EIA-606.

##### Spare Parts; G-AO

Lists of spare parts, tools, and test equipment for each different item of material and equipment specified, after approval of detail drawings, not later than 2months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of spare parts recommended for stocking.

##### Manufacturer's Recommendations; G-AO

Where installation procedures, or any part thereof, are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations, prior to installation shall be provided. Installation of the item will not be allowed to proceed until the recommendations are received and approved.

##### Test Plan; G-AO

Test plan defining the tests required to ensure that the system meets technical, operational and performance specifications, 60

days prior to the proposed test date. The test plan must be approved before the start of any testing. The test plan shall identify the capabilities and functions to be tested, and include detailed instructions for the setup and execution of each test and procedures for evaluation and documentation of the results.

Qualifications; G-AO

The qualifications of the Manufacturer, Contractor, and the Installer to perform the work specified herein. This shall include proof of the minimum qualifications specified herein.

#### SD-06 Test Reports

Test Reports; G-AO

Test reports in booklet form with witness signatures verifying execution of tests. Test results will also be provided on electronic media using Windows base computer cable management software (Microsoft Access Program). Reports shall show the field tests performed to verify compliance with the specified performance criteria. Test reports shall include record of the physical parameters verified during testing. Test reports shall be submitted within 7 days after completion of testing.

#### SD-07 Certificates

Premises Distribution System; G-AO

Written certification that the premises distribution system complies with the EIA ANSI/TIA/EIA-568-B.2-1, EIA ANSI/TIA/EIA-569-A, and EIA ANSI/TIA/EIA-606 standards.

Materials and Equipment; G-AO

Where materials or equipment are specified to conform, be constructed or tested to meet specific requirements, certification that the items provided conform to such requirements. Certification by a nationally recognized testing laboratory that a representative sample has been tested to meet the requirements, or a published catalog specification statement to the effect that the item meets the referenced standard, will be acceptable as evidence that the item conforms. Compliance with these requirements does not relieve the Contractor from compliance with other requirements of the specifications.

Installers; G-DO

The Contractor shall submit certification that all the installers are factory certified to install and test the provided products.

### 1.5 QUALIFICATIONS

#### 1.5.1 Minimum Contractor Qualifications

All work under this section shall be performed by and all equipment shall be furnished and installed by a certified Telecommunications Contractor, hereafter referred to as the Contractor. The Contractor shall have the

following qualifications in Telecommunications Systems installation:

- a. Contractor shall have a minimum of 3 years experience in the application, installation and testing of the specified systems and equipment.
- b. All supervisors and installers assigned to the installation of this system or any of its components shall have factory certification from each equipment manufacturer that they are qualified to install and test the provided products.
- c. All installers assigned to the installation of this system or any of its components shall have a minimum of 3 years experience in the installation of the specified copper and fiber optic cable and components.

#### 1.5.2 Minimum Manufacturer Qualifications

The equipment and hardware provided under this contract will be from manufacturers that have a minimum of 3 years experience in producing the types of systems and equipment specified.

#### 1.6 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust or other contaminants.

#### 1.7 OPERATION AND MAINTENANCE MANUALS

Commercial off the shelf manuals shall be furnished for operation, installation, configuration, and maintenance for all products provided as a part of the premises distribution system. Specification sheets for all cable, connectors, and other equipment shall be provided.

#### 1.8 RECORD KEEPING AND DOCUMENTATION

##### 1.8.1 Cables

A record of all installed cable shall be provided on electronic media using Windows based computer cable management software. The cable records shall include the required data fields for each cable and complete end-to-end circuit report for each complete circuit from the assigned outlet to the entry facility.

##### 1.8.2 Termination Hardware

A record of all installed patch panels and outlets shall be provided on electronic media using Windows based computer cable management software. A licensed copy of the cable management software including documentation, shall be provided. The hardware records shall include only the required data fields.

### PART 2 PRODUCTS

#### 2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall be the

manufacturer's latest standard design that has been in satisfactory use for at least 1 year prior to installation. Materials and equipment shall conform to the respective publications and other requirements specified below and to the applicable requirements of NFPA 70.

## 2.2 UNSHIELDED TWISTED PAIR CABLE SYSTEM

### 2.2.1 Backbone Cable

Backbone cable shall meet the requirements of EIA ANSI/TIA/EIA-568-B for Category 3 100-ohm unshielded twisted pair cable. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Conductors shall be solid untinned copper 24 AWG. Cable shall be rated CMP per NFPA 70.

### 2.2.2 Horizontal Cable

Horizontal cable shall meet the requirements of EIA ANSI/TIA/EIA-568-B.2-1 for Category 5e. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Cable shall be rated CMG or CMP, as appropriate, per NFPA 70.

### 2.2.3 Connecting Hardware

Connecting and cross-connecting hardware shall be the same category as the cable it serves. Hardware shall be in accordance with EIA ANSI/TIA/EIA-568-B.

#### 2.2.3.1 Telecommunications Outlets

Outlet assemblies used in the premises distribution system shall consist of modular jacks assembled into both simplex and duplex outlet assemblies in single or double gang covers as indicated on the drawings. Wall and desk outlet plates shall come equipped with two modular jacks, with the top jack labeled "voice" and the bottom jack labeled "data" or one modular jack as indicated on the drawings. Modular jacks shall be the same category as the cable they terminate and shall meet the requirements of EIA ANSI/TIA/EIA-568-B and shall meet the Link Test parameters as listed in EIA TIA/EIA-TSB-67 and supplemented by EIA ANSI/TIA/EIA-568-B.2-1. Modular jack pin/pair configuration shall be T568A per EIA ANSI/TIA/EIA-568-B. Modular jacks shall be unkeyed. Faceplates shall be provided and shall be ivory in color, impact resistant plastic. Mounting plates shall be provided for system furniture and shall match the system furniture in color.

#### 2.2.3.2 Patch Panels

Patch panels shall consist of eight-position modular jacks, with rear mounted type 110 insulation displacement connectors, arranged in rows or columns on 19 inch rack mounted panels. Jack pin/pair configuration shall be T568A per EIA ANSI/TIA/EIA-568-B. Jacks shall be unkeyed. Panels shall be labeled with alphanumeric x-y coordinates. The modular jacks shall conform to the requirements of EIA ANSI/TIA/EIA-568-B, and shall be rated for use with Category 5e cable in accordance with EIA ANSI/TIA/EIA-568-B.2-1 and shall meet the Link Test parameters as listed in EIA TIA/EIA-TSB-67 and supplemented by EIA ANSI/TIA/EIA-568-B.2-1.

#### 2.2.3.3 Patch Cords

Patch cords shall be cable assemblies consisting of flexible, twisted pair stranded wire with eight-position plugs at each end. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Patch cords shall be wired straight through; pin numbers shall be identical at each end and shall be paired to match T568A patch panel jack wiring per EIA ANSI/TIA/EIA-568-B. Patch cords shall be unkeyed. Patch cords shall be factory assembled. Patch cords shall conform to the requirements of EIA ANSI/TIA/EIA-568-B.2-1 for Category 5e.

#### 2.2.3.4 Terminal Blocks

Terminal blocks shall be wall mounted wire termination units consisting of insulation displacement connectors mounted in plastic blocks, frames or housings. Blocks shall be type 110 which meet the requirements of EIA ANSI/TIA/EIA-568-B, and shall be rated for use with Category 6 cable in accordance with EIA ANSI/TIA/EIA-568-B.2-1 and shall meet the Link Test parameters as listed in EIA TIA/EIA-TSB-67 and supplemented by EIA ANSI/TIA/EIA-568-B.2-1. Blocks shall be mounted on standoffs and shall include cable management hardware. Insulation displacement connectors shall terminate 22 or 24 gauge solid copper wire as a minimum, and shall be connected in pairs so that horizontal cable and connected jumper wires are on separate connected terminals.

### 2.3 COAXIAL CABLE SYSTEM

#### 2.3.1 Backbone Cable

Backbone cable shall meet the requirements of EIA ANSI/TIA/EIA-568-B 10BASE5 for coaxial cable. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Cable shall be rated CMP per NFPA 70. Cable shall have band markings every 8 feet for transceiver tap placement.

#### 2.3.2 Horizontal Cable

Horizontal cable shall meet the requirements of EIA ANSI/TIA/EIA-568-B 10BASE2 for coaxial cable. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Cable shall be rated CMP per NFPA 70.

#### 2.3.3 Connecting Hardware

##### 2.3.3.1 Connectors

Connectors shall meet the requirements of EIA ANSI/TIA/EIA-568-B 10BASE5 or 10BASE2 for coaxial cable connectors, as required for the service. Connectors for riser/backbone cable shall be Type N male. Connectors for station cable shall be BNC male. Station cable faceplates shall be provided and shall be ivory in color, impact resistant plastic, single gang, with double-sided female BNC coupler. Mounting plates shall be provided for system furniture and shall match the furniture system in color.

### 2.4 EQUIPMENT RACKS

#### 2.4.1 Floor Mounted Open Frame

Floor mounted equipment racks shall be aluminum relay racks with uprights to mount equipment 19 inches wide. Uprights shall be 3 inch deep channel,

1-1/4 inches wide, drilled and tapped 12-24 in a 1/2 inch pattern. Racks shall be provided with a standard top crossmember, and predrilled base plate to allow floor fastening. Open frame equipment racks shall be 7 feet in height and clear coated. AC outlets shall be provided as shown.

#### 2.4.2 Cable Guides

Cable guides shall be specifically manufactured for the purpose of routing cables, wires and patch cords horizontally and vertically on 19 inch equipment racks. Cable guides shall consist of ring or bracket-like devices mounted on rack panels for horizontal use or individually mounted for vertical use. Cable guides shall mount to racks by screws and/or nuts and lockwashers.

#### 2.5 EQUIPMENT MOUNTING BACKBOARD

Plywood backboards shall be provided, sized as shown, painted with white or light colored paint.

#### 2.6 TELECOMMUNICATIONS OUTLET BOXES

Electrical boxes for telecommunication outlets shall be 4-11/16 inch square by 2-1/8 inches deep with minimum 3/8 inch deep single or two gang plaster ring as shown. Provide a minimum 1 inch conduit.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

System components and appurtenances shall be installed in accordance with NFPA 70, manufacturer's instructions and as shown. Necessary interconnections, services, and adjustments required for a complete and operable signal distribution system shall be provided. Components shall be labeled in accordance with EIA ANSI/TIA/EIA-606. Penetrations in fire-rated construction shall be firestopped in accordance with Section 07840A FIRESTOPPING. Conduits, outlets and raceways shall be installed in accordance with Section 16415A ELECTRICAL WORK, INTERIOR. Wiring shall be installed in accordance with EIA ANSI/TIA/EIA-568-B and as specified in Section 16415A ELECTRICAL WORK, INTERIOR. Wiring, and terminal blocks and outlets shall be marked in accordance with EIA ANSI/TIA/EIA-606. Cables shall not be installed in the same cable tray, utility pole compartment, or floor trench compartment with ac power cables. Cables not installed in conduit or wireways shall be properly secured and neat in appearance and, if installed in plenums or other spaces used for environmental air, shall comply with NFPA 70 requirements for this type of installation.

##### 3.1.1 Horizontal Distribution Cable

The rated cable pulling tension shall not be exceeded. Cable shall not be stressed such that twisting, stretching or kinking occurs. Cable shall not be spliced. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items. Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 12 inches shall be maintained when such placement cannot be avoided. Cables shall be terminated; no cable shall contain unterminated elements. Minimum bending radius shall not be exceeded during installation or once installed.

##### 3.1.2 Riser and Backbone Cable

Vertical cable support intervals shall be in accordance with manufacturer's recommendations. Cable bend radius shall not be less than ten times the outside diameter of the cable during installation and once installed. Maximum tensile strength rating of the cable shall not be exceeded. Cable shall not be spliced.

### 3.1.3 Telecommunications Outlets

#### 3.1.3.1 Faceplates

As a minimum each jack shall be labeled as to its function and a unique number to identify cable link.

#### 3.1.3.2 Cables

Unshielded twisted pair and fiber optic cables shall have a minimum of 6 inches of slack cable loosely coiled into the telecommunications outlet boxes. Minimum manufacturers bend radius for each type of cable shall not be exceeded.

#### 3.1.3.3 Pull Cords

Pull cords shall be installed in all conduit serving telecommunications outlets which do not initially have fiber optic cable installed.

#### 3.1.4 Terminal Blocks

Terminal blocks shall be mounted in orderly rows and columns. Adequate vertical and horizontal wire routing areas shall be provided between groups of blocks. Industry standard wire routing guides shall be utilized.

#### 3.1.5 Unshielded Twisted Pair Patch Panels

Patch panels shall be mounted in equipment racks with sufficient modular jacks to accommodate the installed cable plant plus 10 percent spares. Cable guides shall be provided above, below and between each panel.

#### 3.1.6 Equipment Racks

Open frame equipment racks shall be bolted to the floor slab. Cable guides shall be bolted or screwed to racks. Racks shall be installed level.

#### 3.1.7 Rack Mounted Equipment

Equipment to be rack mounted shall be securely fastened to racks by means of the manufacturer's recommended fasteners.

#### 3.1.8 Spare Parts

The Contractor shall provide spare parts data for each different item of material and equipment specified, after approval of the related submittals and not later than the start of the field tests.

### 3.2 TERMINATION

Cables and conductors shall sweep into termination areas; cables and conductors shall not bend at right angles. Manufacturer's minimum bending radius shall not be exceeded. When there are multiple system type drops to

individual workstations, relative position for each system shall be maintained on each system termination block or patch panel.

### 3.2.1 Unshielded Twisted Pair Cable

Each pair shall be terminated on appropriate outlets, terminal blocks or patch panels. No cable shall be unterminated or contain unterminated elements. Pairs shall remain twisted together to within the proper distance from the termination as specified in EIA ANSI/TIA/EIA-568-B. Conductors shall not be damaged when removing insulation. Wire insulation shall not be damaged when removing outer jacket.

### 3.2.2 Coaxial Cable

Home run type station cables shall be terminated at each end. Backbone cables shall be terminated with appropriate connectors or end-of-line terminators as required. Loop-type cable systems shall be terminated with appropriate drop connectors and terminators as required. Backbone cable shield conductor shall be grounded to communications ground at only one point and shall not make electrical contact with ground anywhere else.

## 3.3 GROUNDING

Signal distribution system ground shall be installed in the telecommunications entrance facility and in each telecommunications closet in accordance with EIA ANSI/TIA/EIA-607 and Section 16415A ELECTRICAL WORK, INTERIOR. Equipment racks shall be connected to the electrical safety ground.

## 3.4 ADDITIONAL MATERIALS

The Contractor shall provide the following additional materials required for facility startup.

- a. 10 of each type outlet.
- b. 10 of each type cover plate.
- c. 1 of each type terminal block for each telecommunications closet.
- d. 4 Patch cords of 10 feet for each telecommunications closet.
- e. 1 Set of any and all special tools required to establish a cross connect and to change and/or maintain a terminal block.

## 3.5 ADMINISTRATION AND LABELING

### 3.5.1 Labeling

#### 3.5.1.1 Labels

All labels shall be in accordance with EIA ANSI/TIA/EIA-606.

#### 3.5.1.2 Cable

All cables will be labeled using color labels on both ends with unencoded identifiers per EIA ANSI/TIA/EIA-606.

#### 3.5.1.3 Termination Hardware

All workstation outlets and patch panel connections will be labeled using color coded labels with unencoded identifiers per EIA ANSI/TIA/EIA-606.

### 3.6 TESTING

Materials and documentation to be furnished under this specification are subject to inspections and tests. All components shall be terminated prior to testing. Equipment and systems will not be accepted until the required inspections and tests have been made in accordance with the approved Test Plan submitted by the Contractor, demonstrating that the signal distribution system conforms to the specified requirements, and that the required equipment, systems, and documentation have been provided. The Contractor shall submit Test Reports as they are completed.

#### 3.6.1 Unshielded Twisted Pair Tests

All metallic cable pairs shall be tested for proper identification and continuity. All opens, shorts, crosses, grounds, and reversals shall be corrected. Correct color coding and termination of each pair shall be verified in the communications closet and at the outlet. Horizontal wiring shall be tested from and including the termination device in the communications closet to and including the modular jack in each room. Backbone wiring shall be tested end-to-end, including termination devices, from terminal block to terminal block, in the respective communications closets. These test shall be completed and all errors corrected before any other tests are started.

#### 3.6.2 Category 5e Circuits

All category 5e circuits shall be tested using a test set that meets the Class II accuracy requirements of EIA TIA/EIA-TSB-67 standard, including the additional tests and test set accuracy requirements of EIA ANSI/TIA/EIA-568-B.2-1. Testing shall use the Basic Link Test procedure of EIA TIA/EIA-TSB-67, as supplemented by EIA ANSI/TIA/EIA-568-B.2-1. Cables and connecting hardware which contain failed circuits shall be replaced and retested to verify the standard is met.

#### 3.6.3 Coaxial Cable

Cable shall be tested for continuity, shorts and opens. Characteristic impedance shall be verified over the range of intended operation. Cable length shall be verified. Cable shall be sweep tested for attenuation over the range of intended operation.

-- End of Section --